THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXI. No. 1819.] LONDON, MARCH 22, 1898. [50TH YEAR. PRICE 6d.

TUBES AND FITTINGS
FOR
GAS, STEAM, WATER,
AND ALL PURPOSES,
ALSO
COILS OF EVERY SIZE AND SHAPE.

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ESTABLISHED 1861.

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LANEMARK CANNEL AND GAS COALS.
Quotations and Analysis on Application to
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Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores, for Gas and Water Works.
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Specially distil Carburine Spirit, specific gravity ·680, or of any other grade suitable for Enriching Gas; also Gas Oil best adapted for injecting into the Retorts, as in the Herring Process.
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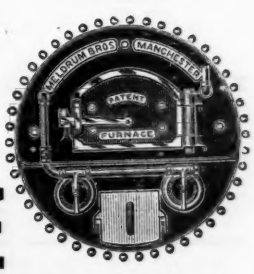
BREEZE FURNACE



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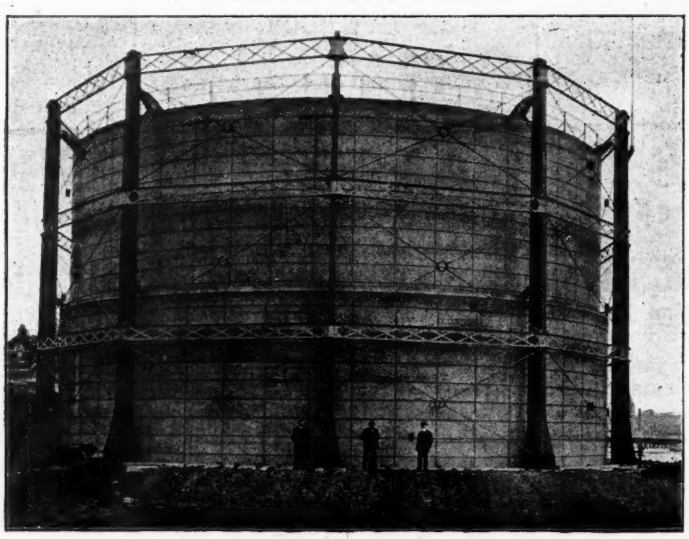

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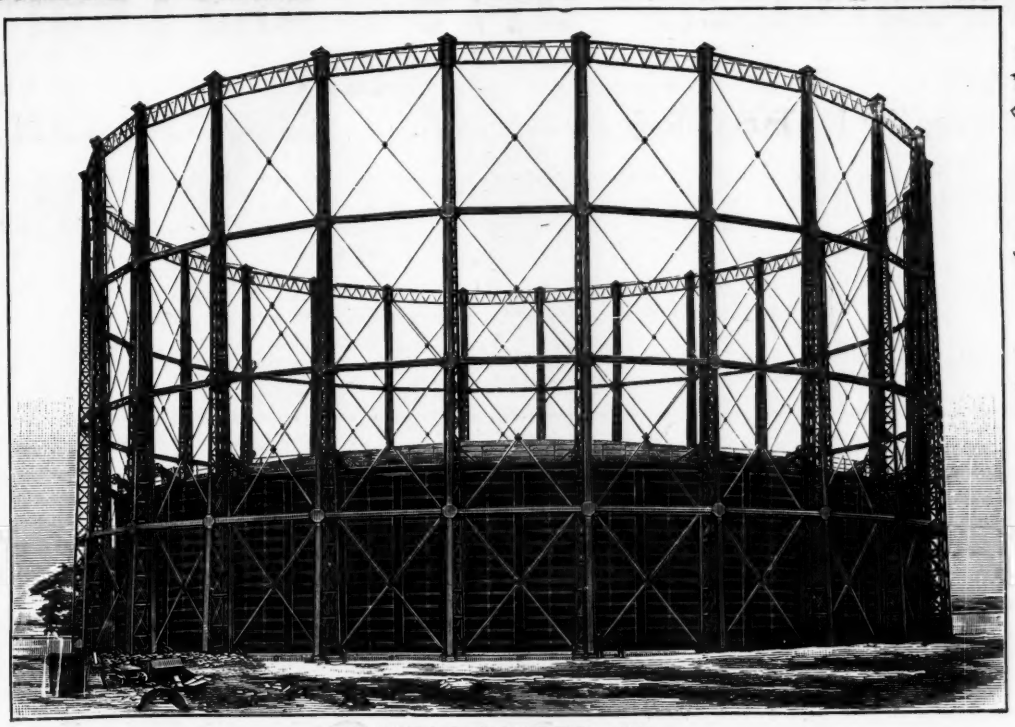

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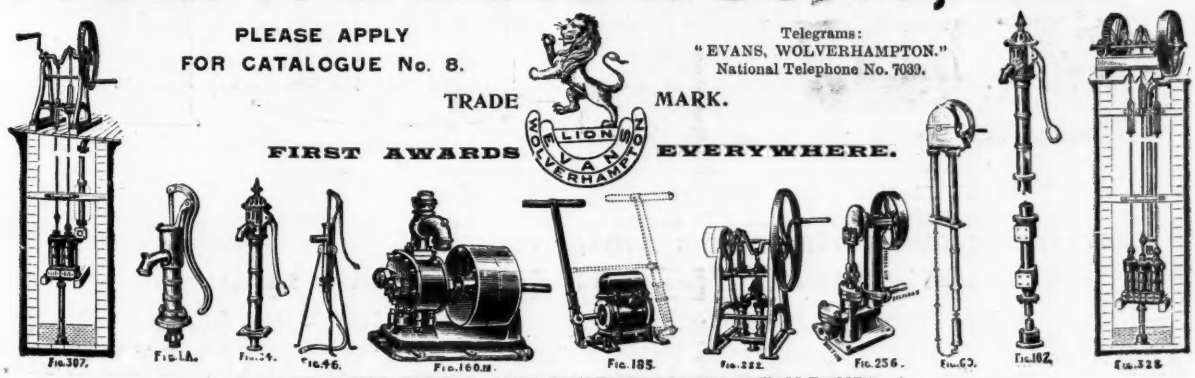

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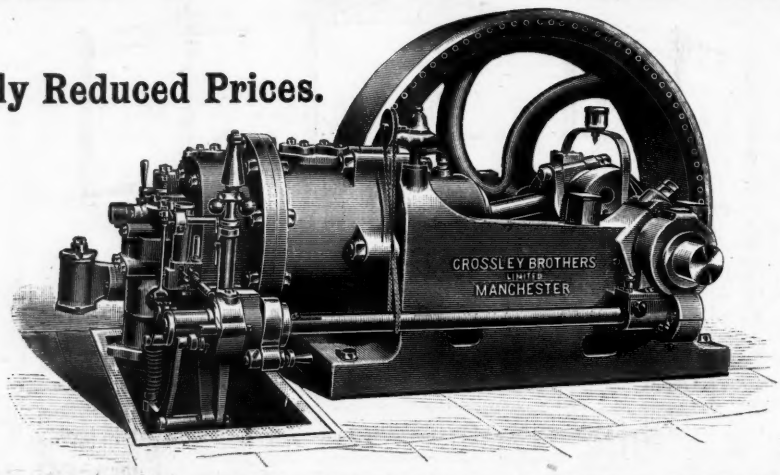

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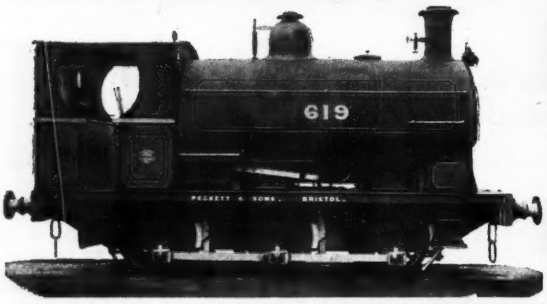

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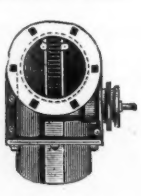

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And Retort-House Appliances of every description,

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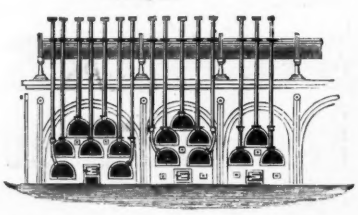

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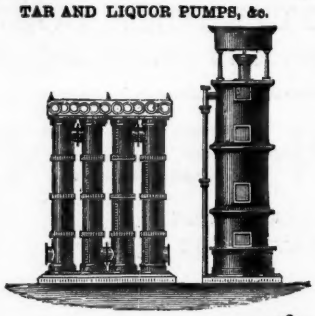
CONDENSERS, SCRUBBERS, & WASHERS,

TAR AND LIQUOR PUMPS, &c.



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CENTRE-VALVES

for working Purifiers,

Also Bye-Pass & Stop Valves

PURIFIERS with Planed Joints,

HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS, and SPECIALS.

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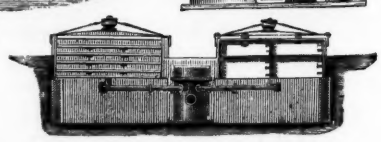

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Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

INCANDESCENT GAS-LIGHT

(WELSBACH PATENTS).

THE GREATLY REDUCED CONSUMPTION OF GAS COVERS THE INITIAL COST OF THE BURNER IN LESS THAN SIX MONTHS.

The Ordinary "C" Burner,
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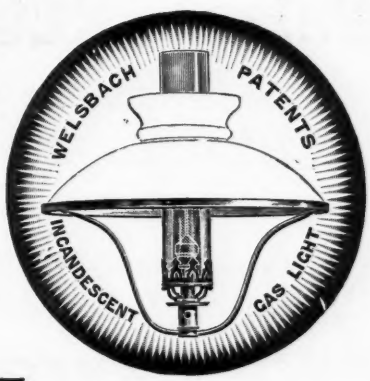
Prices of other Patterns Reduced Proportionately.



The attention of Gas Managers and Gas Engineers is called to this System of Lighting as one which tends to **Popularize the Use of Gas** as an Illuminant, owing to the following Advantages:—

Economy in Consumption of Gas, combined with High Illuminating Efficiency.
Freedom from Smoke, Dirt, and Flickering.
Greatly Reduced Heat.
The combination of High Lighting Power with DURABILITY can only be obtained by The Welsbach System.

The **"Lancet" Special Analytical and Sanitary Commission,** in an exhaustive report, pronounces the "Incandescent Gas-Light System" to be the **Healthiest, Best, and most Economical System of Gas Lighting.**

Suitable for every purpose of **Inside and Outside Lighting.**

Avoid the WORTHLESS IMITATIONS now being offered by UNSCRUPULOUS INFRINGERS.

OVER ONE HUNDRED AND FIFTY JUDGMENTS

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FOR FURTHER PARTICULARS, APPLY TO

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GIBBONS BROTHERS, LIMITED,

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GAS ENGINEERS, CONTRACTORS, RETORT SETTERS.

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SUITABLE FOR WORKS OF EVERY CAPACITY,

AND A SPECIAL FORM OF WHICH IS APPLICABLE TO

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MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

OVER **60** MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.

Among the Companies supplied are The Gas Light and Coke Company, The South Metropolitan Gas Company, Birmingham Corporation, Manchester Corporation, Rochdale Corporation, Bristol Gas Company, and many other Works, both large and small, where they have been working in some instances for the past **Seven Years.**

MORE GAS & SALEABLE COKE PER TON of COAL CARBONIZED is PRODUCED; SAVING CAPITAL, LABOUR, FUEL, WEAR & TEAR, &c.

THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

SOLE AGENTS FOR REDWOOD & CLOWES' INFLAMMABLE VAPOUR & GAS DETECTORS.

Dealers in Carburine and all other Naphthas and Oils suitable for the Enrichment of Gas.

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THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

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TELEGRAMS: "FIRECLAY," LEEDS. TELEPHONE No. 612.

COAL and COKE Breakers, Elevators, AND Conveyors.

RETORTS, Bricks, Blocks, Tiles, &c.

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EVERY DESCRIPTION OF

RETORT SETTINGS AND IRONWORK.

WE GUARANTEE RESULTS.

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We desire to call attention to our SHALLOW REGENERATIVE SETTINGS, which are comparatively inexpensive to erect, and productive of excellent results. They are specially designed to suit those Retort Houses where for various reasons it is undesirable to excavate to any great depth.

We shall be pleased to furnish Designs and Estimates on application.

THE LEEDS FIRECLAY CO. LTD., ENGINEERING DEPARTMENT, WORTLEY, nr. LEEDS.

THE "TRAFALGAR"

PREPAYMENT GAS-METER

FOR PENCE, SHILLINGS, OR ANY COINAGE.

THE ADVANTAGES OF THIS SYSTEM ARE:

1. Simplicity of Mechanism.
2. Absolute Accuracy.
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4. Unaffected by irregularities in shape or thickness of the penny.
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8. Index showing number of Pennies in the mechanism at any time.
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GUARANTEED FOR FIVE YEARS.

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OIL FOR GAS MAKING

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HOMOGENEOUS IN CHARACTER.

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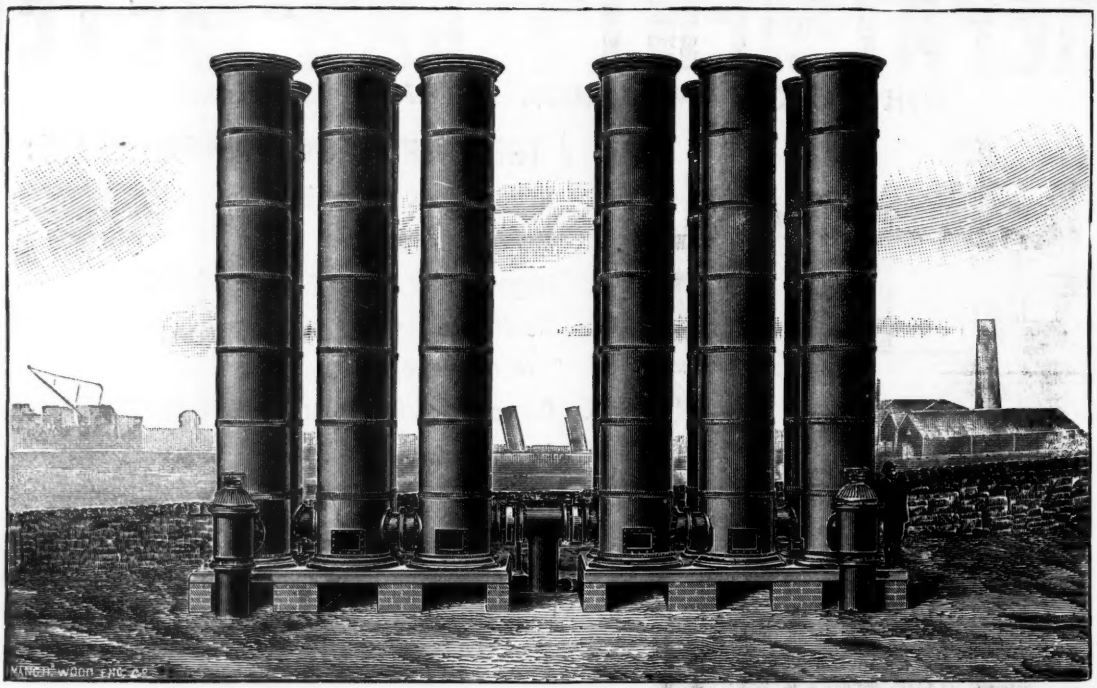

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A Set of Twelve Condensers, 4 ft. diameter by 28 ft. high. *From a Photograph*

Makers of Retort Ironwork, Patent Scrubber-Washers, Purifiers, Gasholders of all sizes, and Gas Plant and Structural Ironwork of every description.

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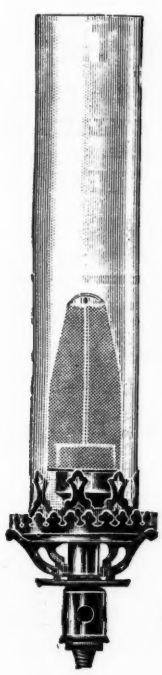
THE SUNLIGHT INCANDESCENT GAS-BURNER.

NEW POPULAR PRICES.

BURNERS



COMPLETE FROM

3/10 each.

WITH BYE-PASS, 5/-.

MANTLES

per 9/- doz.

THE IDEAL LIGHT FOR DOMESTIC USE.

SUNLIGHT MANTLES

PRODUCE A DIFFUSED LIGHT OF SOFT RAYS,

The NEAREST APPROACH to the LIGHT of the SUN.

Price Lists, &c., on application.

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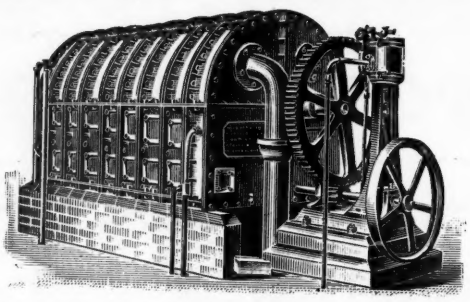
PATENT "STANDARD" WASHER-SCRUBBER.

This Apparatus upholds its title, the "STANDARD;" being recognized by leading Engineers as the most efficient Apparatus for the Extraction of Ammonia from Coal or other Gases.



The Largest Order ever given for WASHER-SCRUBBERS was recently received being for **16** Patent "Standard" Washer-Scrubbers, each for 3,500,000 Cubic Feet of Gas per day.

Number of Patent "STANDARD" Washer-Scrubbers in use at this date

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THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

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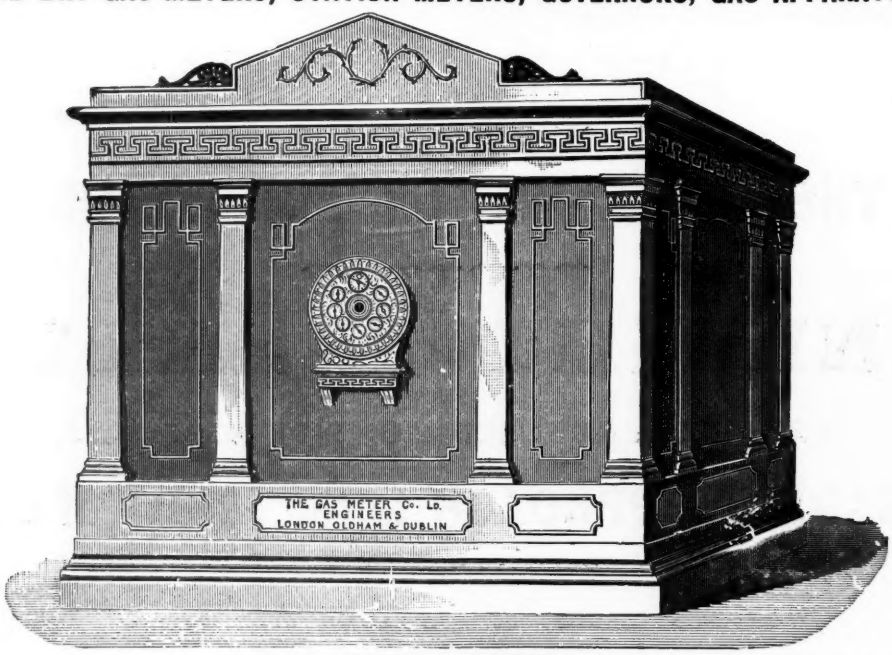
THE GAS-METER COMPANY, LIMITED

MANUFACTURERS OF

WET AND DRY GAS-METERS, STATION METERS, GOVERNORS, GAS APPARATUS, ETC.

SQUARE STATION METERS WITH PLANED JOINTS.



STATION METERS IN CYLINDRICAL CASES.

DESIGN No. 2 PATTERN.

STATION METERS MADE AT THE COMPANY'S WORKS, OLDHAM, Late WEST & GREGSON. Established 1830.

For Prices and Particulars apply to

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Telegraphic Address: "METER."

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SINCE 1893

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Have constructed or have in hand

CARBURETTED WATER-GAS PLANT

FOR THE FOLLOWING UNDERTAKINGS:—

	Cub. Ft. Daily.		Cub. Ft. Daily.
Copenhagen	700,000	Norwich	1,000,000
Belfast	1,700,000	Holyoke, Mass.	600,000
Belfast (Second Contract)	4,500,000	Edinburgh	2,000,000
Glasgow	300,000	St. Joseph, Mo.	750,000
Brussels	700,000	Lea Bridge	350,000
Brussels (Second Contract)	700,000	Lea Bridge (Second Contract)	350,000
Liverpool	3,500,000	Guildford	350,000
Tottenham	750,000	Stockton-on-Tees	500,000
Tottenham (Second Contract)	750,000	Syracuse, N.Y.	850,000
Santiago	400,000	Brentford	1,200,000
Swansea	750,000	Commercial Gas Co.	850,000
Manchester	3,000,000	Commercial Gas Co. (Second Contract)	850,000
Brighton	1,750,000	Bridlington	125,000
Preston	1,500,000	Middlesbrough	1,250,000
New York	1,200,000	Croydon	1,250,000
Southport	750,000	L. & N.W. Railway, Crewe	700,000
Bath	1,000,000	Taunton	225,000
Newburgh, N.Y.	350,000	Lawrence, Mass.	400,000
Newburgh, N.Y. (Second Contract)	250,000	Rotterdam	850,000
Hoylake	125,000	Dorking	125,000
Coventry	600,000	McKeesport, Pa.	500,000
Coventry (Second Contract)	600,000	The Gaslight and Coke Co., Bromley	3,750,000
Bordentown, N.J.	125,000	The Gaslight and Coke Co., Nine Elms	2,750,000
Winchester	200,000	Durham	200,000
Shanghai	225,000	New York (Remodelled)	11,000,000
Stockport	500,000	Scarborough	800,000
		Perth, W.A.	125,000

LIVERPOOL (Second Contract) . . . . . 4,500,000 Cubic Feet.

In addition to which the 1891 Installations of The Gaslight and Coke Company, on the Humphreys' Double-Superheater System, have a capacity of 12,000,000 Cubic Feet per diem.

IN THE UNITED STATES,

Messrs. Humphreys and Glasgow and the United Gas Improvement Company have jointly constructed **252** Sets of Humphreys' Double-Superheater Apparatus; **139** of these since **1893.** This Company (of which Mr. Humphreys was formerly Chief Engineer) were, until lately, the largest Constructors of Carburetted Water-Gas Apparatus in the World.

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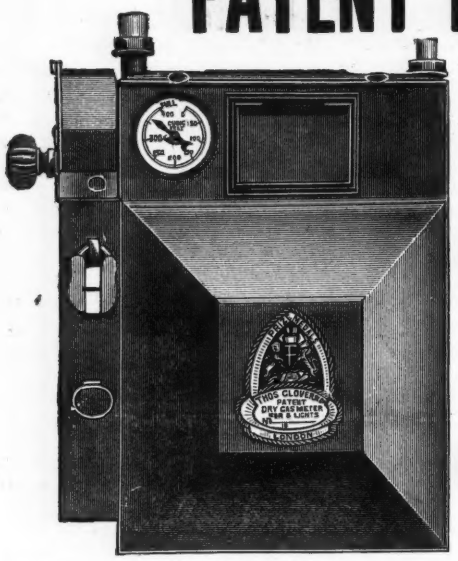

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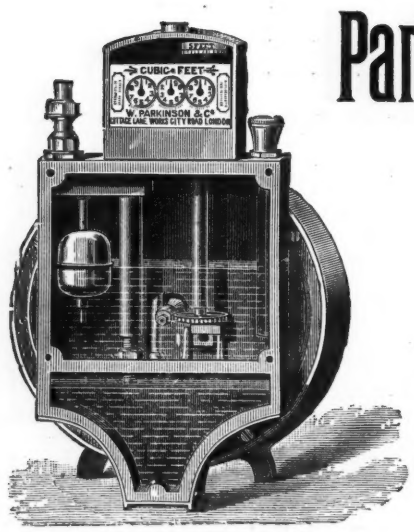

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EDITORIAL NOTES.

Progress of Gas Bills in Parliament.

PROGRESS is being made with the Gas Bills in Parliament. In the case of the Aberystwith Bill, which came before a House of Lords Committee last Wednesday, the opposition of the Corporation was peculiarly conditioned. The Corporation wanted power to purchase the undertaking at any time within thirty years; and this privilege the Company did not wish to deny them. The Company, however, desired that, in the event of arbitration being necessary to fix the selling price, this should be under the Lands Clauses Consolidation Act, as being more favourable to the seller than the Arbitration Act. The Corporation contended that inasmuch as the transfer would be an agreed, not a compulsory purchase, the latter procedure would be the proper one to follow. Another subject of contention was the proposed initial price, under the sliding-scale, asked for by the promoters. The old maximum is 6s. per 1000 cubic feet; and the Company are selling gas at prices ranging from 4s. to 4s. 7d. They asked for 5s. as the initial; while the opposition suggested that the maximum dividends could be earned at a standard price of 3s. 6d. The latter was an unreasonable demand; but the Committee gave the Company an initial price of 4s. 3d., which is therefore that at which they actually supply their largest consumers, and is below the average charge. The precedent is worth noting. The Whitwick and Coalville Gas Bill has passed the Committee of the House of Commons. This Bill contained a proposal for the formation of a renewals fund to the amount of £2000 out of revenue; and much discussion took place on this suggestion between Counsel and the Referee (Mr. Bonham-Carter), who did not like it. But eventually the Committee sanctioned the fund, reduced in amount to £1000, or 5 per cent. on the capital; and cut down the initial price from 5s. to 4s. 2d., which is the present selling price. The "Cowes" clause was inserted, with an alteration. The District Council are to introduce a Transfer Bill into Parliament next session; and the Company are not to oppose. The Redhill Bill was withdrawn, because the Select Committee favoured the insertion of a purchase clause which the promoters could not accept. Among later results, it may be mentioned that a House of Lords Committee yesterday passed the Swansea Gas Bill—the Corporation being defeated on all contested points.

The Affairs of the Sheffield Gas Company.

AT the half-yearly meeting of proprietors in the Sheffield United Gaslight Company, held on Monday of last week under the presidency of Sir F. T. Mappin, the gratifying announcement was made of a reduction of 2d. per 1000 cubic feet in the price of gas. The administration and also the management of the undertaking are to be congratulated on this result of a highly successful year's operations. The trade of Sheffield must have been well maintained, labour troubles notwithstanding, in order that the gas undertaking should have been so prosperous; but increase of business does not always mean reduction of selling price in the case of a gas undertaking. Some things about a gas company are automatic; but wise administration and good management are not among them. Sheffield has every reason to be satisfied with its gas supply. It may be mentioned here that one gentleman at the meeting expressed the hope that there would be a further reduction of price in a year's time. The Chairman remarked, in reply, that "some people "are never satisfied;" and this undoubtedly is so. There are, in Sheffield as everywhere else, people to whose frivolous or prejudiced minds the gas is always dear, and bad, and of wretched illuminating power. Sir F. Mappin mentioned a newspaper complaint of the "wretched illu- "minating quality of Sheffield gas," which was alleged to render perusal of the paper "to persons of indifferent eye- "sight almost a matter of impossibility." He would have been quite justified in retorting that while the perusal of most cheap newspapers is made penible by the wretched quality of the paper and printing, this is happily no loss, inasmuch as the quality of the matter is such as to relieve sensible people of the necessity for making an attempt to read it. Sir F. Mappin is one of those hearty believers in gas who is not content to let the enemies and rivals of the industry have everything their own way. The Sheffield Corporation are now lighting the Town Hall by electricity.

Well and good. They can do as they please with the ratepayers' money; but Sir F. Mappin does not omit to remind the public that electricity at the Town Hall cost £210 for the last quarter of the old year, as against £37 formerly paid for gas. He has got it from Worcester, also, that, as we recorded a fortnight ago, the outlay of the city on electric lighting is £2401 for services previously performed by gas at a cost of £797. "The conclusion was that we "must not believe all that we heard about electricity being "likely to approach the price of gas." Sir F. Mappin is just the man to rub these points well into the appreciation of a popular audience.

Startling Welsbach Announcement—Gas Lighting at Thirty Candles per Cubic Foot.

A most extraordinary story was told on Friday last to the shareholders of the Welsbach Incandescent Gas-Light Company by the Chairman, Sir Henry Burdett. A report of his speech will be found in another column. Much of it was concerned with matters of finance, with which we have nothing to do. Welsbach finance has always been a thing to marvel at; and nobody will be greatly surprised to learn that on the very morrow of a great consolidating operation, which brought all the divisions of the Welsbach interest together, there should be promise of further and still more complicated developments. The truth is that the financing of a creative genius like Dr. Auer von Welsbach is an enterprise which can have no more finality than the work of the man himself. The Auers, the Edisons, and the Maxims, and other original sources of human industry, are not to be limited within one financial ring-fence. What we specially desire to note here, however, is the remarkable announcement made by Sir Henry Burdett respecting the new gas-burner which the Welsbach Company are about to put upon the market. This is a burner which is to develop a lighting efficiency of 30 candles per cubic foot of gas consumed. Not only is it to do this, but it is to do it always, under all the ordinary conditions of burning the gas, and with every rate of consumption. Sir Henry, after admitting that with the existing Welsbach light it is a matter of all or nothing, says: "Whether the "new burner consumes half a cubic foot of gas, or ten cubic "feet, or any intermediate quantity, the light given is "always at the rate of 30 candles per cubic foot." If this promise is fulfilled in a handy form of burner, the imagination reels at the contemplation of the revolution that will be effected in the use of gas for lighting. It is stated, moreover, that the new burner is to be without a chimney, which is a long step in the direction of the universalization of the system. Why, after this rate, the gas consumption of an ordinary household may be diminished to one-fifth the previous amount! There will be no more gas-works extensions required for the next five years—which will afford gas managers a splendid opportunity for overhauling their distributing plant. As to public lighting, highway authorities will scarcely know themselves when bargaining for 30-candle street-lamps consuming only a cubic foot of gas per hour. The force of even Scotch economy can no farther go. Altogether, this is the most amazing message we have ever been called upon to convey to our readers.

The Technology of Calcium Carbide and Acetylene.

The subject of carbide of calcium and acetylene lighting was brought under the notice of chemists and engineers last week, as alluded to elsewhere. Of Mr. Fowler's paper it may be said without reserve that it is the best account of the actual position of calcium carbide and acetylene lighting that has yet appeared; but, of course, it will be necessary to study the text of it in full, as it will be published in the "Transactions" of the Institution, with the author's supplementary remarks, and the discussion on it. Mr. Fowler investigated the acetylene question from the point of view of the railway engineer; and the result is both suggestive and instructive. It is a matter of common agreement among railway men that trains will have to be lighted by gas for some time to come. Except in regard to the limited class of trains that are never broken up, electricity is unsuitable for the purpose. Every gas-lit coach is, on the other hand, self-contained; and its gas cylinders can be replenished at all important stations on every line. The competition of the trunk lines, especially from London to the North, is keen enough to give the subject of train lighting high importance in the estimation of the rival managers. Other things being equal, the best-lighted train service is likely to attract the greatest patronage. Consequently, we find the most enterprising railway companies have adopted a high standard of lighting for their carriages; and now take 20-candle power lights as the datum for the service. So brilliant a light, however, can only be afforded by a good regenerative burner without depleting the cylinders at a very inconvenient rate; and even so the question of the duration of the possible storage becomes serious on some routes. Hence the investigation of the capabilities of acetylene undertaken by Mr. Fowler. The inquiry has not been fruitless, inasmuch as it has been found that the addition of from 20 to 30 per cent. of acetylene to the compressed oil gas used for train lighting is advantageous in a degree very fairly set forth by the author. With regard to the burning of acetylene by itself, the chief novel addition to the previously available stock of information seems to be that the air-injector type of burners, such as have been heard of lately in this connection, are successful in overcoming the trouble of choking, but at a great sacrifice of the lighting value of the gas.

Gas Explosion Case at Newcastle.

In our "Legal Intelligence" to-day we are able to give a full report of the important gas explosion case of *Walkers, Parker, and Co., Limited, v. The Newcastle and Gateshead Gas Company*, briefly noticed a fortnight ago. This was a very peculiar case, as will be seen by the evidence adduced. The plaintiffs attempted to build up a claim for damages asserted to have been sustained by their premises by an explosion of gas which occurred at some considerable distance away. In point of fact, the only known explosion took place in the pan of a water-closet belonging to some neighbouring cottages. A man threw a lighted match into the closet-pan; and what was described as a great and terrible explosion followed. The operator, however, was uninjured. The Jury accepted the fact of this particular explosion; but when they were asked to believe that it was the cause of cracked walls, jammed doors, the dislodging of a tramway turntable, and other damage to the lead-works, they failed to see the connection. The main question for the Jury was that of negligence. The Judge held that the Gas Company were only liable for damages caused by an explosion in the event of their not having taken proper care of their mains beforehand. It was abundantly proved that a reasonable amount of care was exercised by the Company; consequently they came victoriously out of the action. It appears, however, from the way in which the issue was left to the Jury, that even if the Company had been found responsible for the explosion on the point of negligence, there would still have been a question to settle as to the connection between the explosion and the distant damage. This would have been a local matter; but the issue upon which the verdict was actually given is of general interest.

Fatal Case of Gas Poisoning at Liverpool.

At last it looks as if the man who blows out the gas when he goes to bed had made his appearance in England. For many years examples of this particular kind of imbecile have appeared in the United States, usually as the subject of a Coroner's inquest. The performance has seemed so unaccountable, however, that one has hesitated to believe in its frequent repetition, especially as, from the nature of things, there can be no copying in such a case. We have had our experiences of gas poisoning in this country; but never has there been such a strange case in point as that investigated by the Liverpool City Coroner last Tuesday. Four Swedish emigrants, when passing through Liverpool, went to a registered lodging-house together on the previous Friday evening, and took a bedroom which all occupied. This apartment was 8 ft. 8 in. wide, by 10 ft. 9 in. long, and 10 ft. 4 in. high—not a vast allowance of room for four adults; and it had no fireplace. There were two "venti-"lators;" but the larger of these was closed. The atmosphere must have been more than "snug," with the four occupants and a gas-burner capable, according to the evidence, of passing 7½ cubic feet of gas per hour. Nobody knows what was done to the gas before the last of the four men to remain awake prepared to retire for the night. Three were in bed asleep, and one was sitting up writing by the gaslight, when the party were last seen. Next morning there was a strong smell of gas in the neighbourhood of the room, and the burner-tap was found full on, but the gas was not burning. Two men were on the floor, and two others in bed. All were unconscious; and one—the man who had been seen writing overnight—was past

medical aid. The others recovered. The Jury returned the verdict that the deceased died from carbonic oxide poisoning. In view of the Home Office inquiry that is actually in progress in regard to the supply of carburetted water gas by English gas-works, it is manifestly undesirable to comment upon this story. In view, however, of the report that the Coroner permitted himself to make the observation that "it was important for people to know the "kind of gas they were using," we may ask what effect such knowledge might be expected to have upon Swedish emigrants addicted to extinguishing gas-flames by blowing them out?

Ambulance Teaching in Gas-Works.

THE letter of Surgeon-Major Hutton, on the work of the St. John Ambulance Association, which will be found in our "Correspondence" columns to-day, deserves the attention which it will doubtless receive from gas managers who desire to keep abreast of the times in all matters of works organization. The writer is quite justified in basing his communication on the interesting paper read by Mr. Townsend at the last meeting of the Manchester District Institution of Gas Engineers. In every human occupation there are risks to be run and "emergencies" to be faced. It has been demonstrated over and over again that the one quality that serves men best in these "pinches" is presence of mind. Not the bravest man, nor the cleverest man, nor the man known for all-round goodness to his fellows, comes out best at these times; but simply the readiest man with his wits and his hands. It will generally be found, if the circumstances are inquired into afterwards, that the most self-possessed man in any catastrophe turns out to have been in something of the kind before. It is not all strange to him. He has made trial of his powers; and knows how much he can do and how to do it. All this is just the thing that "first aid" classes aim at supplying. Whether to prop a fainting man up, or lay him down; whether to run him around, or carry him right off the ground; how to lift a broken leg so as not to make a simple fracture into a compound one—these are things that do not come by Nature to all men, if to any. We have always advocated the teaching of ambulance work to gas-works employees; and there are numerous good examples in point up and down the country. There is, however, plenty of room for more teaching of the kind; and we are therefore most pleased to commend Surgeon-Major Hutton's letter to the attention of all whom it may concern.

"Public Opinion" and Gas Companies.

AN article on "Gas-Works Management and Consumers' "Interests," by "A Director," appeared in "Chambers's "Journal" for February. It is a well-written statement of the position of Gas Companies in the community, and is calculated to remove from readers much of the misconception which the author finds existing in this regard. The main purpose of the writer is to show that "consumers have a direct, and by no means insignificant, "interest in a gas company." This, it is explained, is owing to the beneficent legislation whereby, after the legitimate interest of the proprietors is satisfied, all further advantage redounds to the benefit of consumers. This is really what the gas company's "monopoly" means to the general public—that, the reward of safe capital investments being small, the consumer is much better off under the "monopoly" of a statutory gas company than he would be under any other disposition of the gas supply. The writer cheerfully admits that few people have a good word to say for "the gas man, whether director, manager, collector, or "what not." He must be content to remain fair game for all the habitual grumblers and all the small wits of every community. His gas is always dear: "Gas never "is too cheap anywhere; if it were given free of cost, it "would always be at least bad. . . A reduction of 1d. "in price seems, and is generally considered by the public, "to be a trivial thing. Its real value should, however, "be estimated by the wrath and indignation with which "an increase of a similar amount is received." People habitually accuse a gas-meter of telling lies; but if gas-meters in general did not adhere more closely to the truth than the average grumbler against the company, they would never get sealed. Only the other day we happened to overhear one of these malcontents inveighing in a public place against the local Gas Company. He declared that the pretence of taking the meter index to ascertain the consumption was a farce, inasmuch as the Company always charged what they liked. In his case they had quadrupled the usual bill for a particular quarter, on the score that the meter was wrong, and demanded a surcharge on the same account reaching back over four years. Of course, he had not paid—he was not such a fool! He put the matter in the hands of his solicitor, who had got the Company's charge reduced by one-half; and made them drop the demand for the back quarters. Unknown to this vapourer, among his audience was the Manager of the Company, who laughed at the tale quite as loudly as anybody; but when the story-teller had departed, the official version came out. The yarn was absolutely baseless as well as untrue. Not for more than four years had the Manager received a lawyer's letter concerning a consumer's account. Certainly, no meter account had been quadrupled as alleged; and the Company had never attempted to adjust a rental beyond the quarter in which the amount came into question. Thus is "public opinion" manufactured. The old allegories which styled the same thing "Rumour, painted full of lies," were not far from the mark.

WATER AND SANITARY AFFAIRS.

THE evidence tendered by Sir John Lubbock last week before the Royal Commission on the Water Supply of the Metropolis proved, with all the force that figures could give to it, that the water-rates must necessarily rise in the event of the County Council purchasing the undertakings of the Companies. With this fact clearly before them, it is hardly likely that the proposal to transfer the supply to the Council would be looked upon with favour by those who will have to bear the extra charge. But as the consumers who do not pay are largely in excess of those who do, the question of cost carries less weight with it than would otherwise be the case. The actual customers are not likely to exceed 800,000; while the consumers are 5,750,000. Deducting children, we may still reckon that the non-paying portion of the consumers are largely in the majority. So far as these go towards making up what is called public opinion, we may suppose that their influence would not be particularly felt as opposed to a costly scheme of water supply. Mr. Dickinson says that the tendency all over the country is for the water supply to be in the hands of the consumers themselves. If those who live in London, and who pay water-rates, saw that the change which Mr. Dickinson has proposed would—as he himself states—add 30 per cent. to the charge, we can hardly think they would care to pay the difference in order to enjoy the privilege of taking the supply, as it is said, into their own hands—which really means putting it into the hands of the County Council. It is to be observed that Mr. Dickinson's forecast is based on the assumption that the undertakings can be purchased for £30,000,000; whereas Mr. Haward, the Comptroller of the County Council, estimates the present market value of the stocks of the Water Companies at considerably more than £39,000,000.

Beyond the question of purchasing the existing undertakings, there comes the consideration of what will have to be done in the future. Sir J. Lubbock remarked that, so far as the need for an additional supply arose from an increase in the population, the cost would no doubt be met by additional rates—meaning, of course, by an additional revenue owing to an increase of services. But while an increased consumption could thus be met by new rates, outlay incurred to replace the present supply could not be so compensated. Here Sir J. Lubbock drew a distinction between the County Council and the Companies, as to financial resources. The interest of any new capital which the Companies had to expend would reduce their dividends, if they were left in charge of the supply; whereas in the event of purchase the burden would fall upon the rates. Sir J. Lubbock is as capable as most men of grasping a financial problem; but he is at a loss to understand how Sir A. Binnie could have expressed the opinion that if the County Council purchased the water undertakings and afterwards expended £20,000,000 in bringing a supply from Wales, the rates would be reduced. There are, certainly, some very sanguine expectations founded on the idea of what will ensue if the County Council get possession of the Water Companies' revenue. As Sir J. Lubbock observed, purchase is recommended

by its advocates as fraught with a large profit, which would go in relief of the rates. For this tempting suggestion, he could see no solid foundation; and he looked upon the probable effect as exactly the reverse. The argument so frequently used—that several Parliamentary Committees and Commissions had decided in favour of purchase—was well disposed of by Sir John, who observed that although the subject of the water supply had been referred to Committees, in no case were the financial results of purchase considered. This is a point with which the present Commission particularly have to deal, and on which it is most important that the public should be duly informed.

After the very sensible speech which Sir F. Dixon-Hartland delivered on the second reading of the Southwark and Vauxhall Water Bill, we are surprised to find the Chairman of the Thames Conservancy Board inveighing against the Company as having set the House of Commons at defiance, and as actually "stealing" the water that belonged to the river in order to sell it to their customers. The fact is that the Company were obliged to take the water to meet the statutory demands made upon them. Sir F. Dixon-Hartland says they ought to have sought the authority of the House of Commons. This is just what they are doing; and in making the attempt, they are fiercely attacked—the Chairman of the Conservancy taking the opportunity, in moving that a certain instruction be sent to the Committee on the Bill, to launch a species of tirade against the Company. Mr. Stuart Wortley repudiated with indignation the charge that the Company had acted otherwise than honourably, and considered that the House had much reason to complain of the injurious expressions which Sir F. Dixon-Hartland had unnecessarily introduced into his speech. It is difficult to understand what made the Chairman of the Thames Conservancy so exceedingly angry. The Company proposed henceforth to pay for the water; and they were making no attempt to get it for anything less than the full price. It was rather odd that the denunciation indulged in was preceded by a statement that the Conservancy naturally looked on the Water Companies as their friends; the Board deriving a very considerable income from them, whereby they were enabled to carry out necessary works in the upper river. But somehow the Southwark and Vauxhall Company were looked upon as seeking to obtain an advantage over the other Companies, though in what way was by no means evident. The House could make nothing of the indictment, and decided that the question had better be left for the experts to fight out. Mr. Chaplin appealed to his hon. friend to withdraw the instruction; and even Mr. S. Buxton objected to it as much too mandatory. So the instruction came to nothing; and the question of whether or not Penton Hook Weir should be the point of measurement for determining the minimum flow was left to the unbiassed judgment of the Committee, assisted by maps and expert evidence.

Chemical Action of the Silent Discharge.—M. Berthelot has been dealing with this subject before the Paris Academy of Sciences; and at a recent sitting he discoursed thereon with special reference to oxides of carbon and nitrogen. Mixtures of carbon monoxide and nitrogen, submitted to the prolonged action of the silent discharge, give only the sub-oxide C_4O_3, the nitrogen being unchanged. With excess of hydrogen, a condensation product of the empirical formula $(CH_2O)_n$ is produced. For carbon dioxide, six hours' action with hydrogen in excess caused the almost complete absorption of the oxide. With nitrogen in addition an amido-compound and some ammonium nitrate were formed.

Smokeless Coal.—A public test of the Wegener method of stoking steam-boilers with dust coal was arranged for on Saturday week at the Hampton pumping-station of the Grand Junction Water Company. The system has been applied by Messrs. Bryan Donkin and Co., and the Hampton test was carried out under the supervision of Sir Frederick Bramwell and Mr. Harris. The steam-raising results of the test have not been published yet; but the fact of the capability of the system as regards burning bituminous coal smokelessly was demonstrated. We have already described the arrangement as operated at Messrs. Donkin's works. It consists in feeding the coal, ground to a fine powder, in a regular stream to the air-blast, which carries it into the combustion chamber built in the place of the usual furnace. The mechanical appliances are very simple; consisting mainly of a turbine worked by the air-blast, which continually knocks the sieve through which the powdered coal has to pass, and consequently ensures its regular delivery. The system, it is admitted on all hands, will not answer with coke.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 671.)

THE Stock Exchange had a much better time last week; and there was a very fair recovery in prices pretty well all round. This was largely owing to the confidence felt that the Spanish-American difficulty will smooth out, and also to a diminution of uneasiness regarding affairs in China, though it would be difficult to point out any incident in the week which promises pacifically in that quarter. The tendency at first was not favourable. Paris set a low tone, and anxiety as to dearer money was felt. But as this anxiety gave way, so things improved. The Bank of England made no change in the rate on Thursday; and the prospect is much relieved. Business in the Gas Market was considerably less in volume; and the agitation of the previous week had quite calmed down. Prices, however, are nearly all uniformly lower; and it is noticeable that the fall is almost entirely confined to the high-class debenture and preference issues. It would seem as if this movement were only the outcome of the demand for money, which has recently put down the prices of the very best railway debenture and preference stocks. The ordinary stocks have scarcely moved at all. In Gaslights, the "A" was only moderately dealt in at very level figures almost every day—ranging only from about 294 to 296—and closed firm at about the same. Very little was done in the secured issues; but directly some were offered in the market, the price was lowered all round. A moderate amount was done in South Metropolitan at unchanged figures; but the debenture was put down a point. A little business in Commercials took place at the old prices. The Company hold their belated meeting on the 7th prox., when the half-year's history of the Metropolitan Companies will be completed. Not much was marked in Suburbans and Provincials; but prices were put down without business done. Alliance, Brentford preference, Bristol, and Crystal Palace retrograded. Among the Continental Companies, there was some brisk work in Union, and quieter dealing in Imperial, without resulting in any change of the old quotations. Other movements comprised a fall in Bombay and Buenos Ayres shares; but the latter's debentures advanced to par. Business in Water was sluggish; and the tendency was duller—a few very slight falls in quotations being apparent.

The daily operations were: Business in Gas on Monday would have been very quiet, but for active dealing in Continental Union. Gaslight 4 per cent. and 4½ per cent. debenture fell 2; and both Bombays, ½; but Buenos Ayres debenture rose 1. There was more general activity on Tuesday; but the only change was a fall of 3 in Brentford preference. West Middlesex Water fell 1. Transactions continued restricted on Wednesday. Gaslight "H" receded 2½; Crystal Palace, 3. Thursday also was adverse to some of the choicest issues. Gaslight "C," "D," and "E" fell 5; ditto "J," 3; and South Metropolitan debenture, 1. Similar movements were the characteristic of Friday. In Gaslights, the "H," the "K," and the 4 per cent. debenture fell 2 each; and the 4½ per cent. and 6 per cent. debenture, 3 each. Bristol also had a relapse of 3; and Alliance, 1. In Water, Chelsea and West Middlesex lost 2 each. Saturday was steady generally; but Buenos Ayres fell ½.

ELECTRIC LIGHTING MEMORANDA.

More about Lamps—How Modern Incandescent Lamps are Made—The Interest of the Consumer—Compound Filaments Useless—The Conclusion of the Matter.

A REVISED report of the discussion on high-voltage incandescent electric lamps at the Institution of Electrical Engineers appears in the current number of the "Electrician," and forms instructive reading for those who are interested in the subject from the point of view of the public. Generally speaking, this report goes to confirm the impression we have all along entertained, that the change from 100 to 200 and 230 volts has not been beneficial to the consumer, at least if regarded as a lamp user. In the long run, if the higher voltage realizes the expectation formed about it by central station managers, and enables the cost of supplying current to be sensibly reduced, then the consumer will have his share of the improved circumstances of the undertaking. This eventuality can only come to pass, however, in the case of really well-to-do undertakings. Where the speculation is an unprofitable one the introduction of high voltage will only enable the management to save a little; while all the extra expense and annoyance due to the higher strain upon the lamps and house fittings will fall upon the consumer. In no case, moreover, is the consumer consulted. He has to put up with what the central station people choose to send him. Mr. C. H. Wordingham, of Manchester, remarked at the Institution, in criticism of Mr. Byng's statement that the success of the 200-volt system would depend upon the verdict of the consumer, that "he did not see what choice the consumer had in the matter." The customers of the Kensington Company have lately been changed over compulsorily to the higher voltage; and a good

many of them have complained of the lighting being worse than before. Of course, it is idle to ask the average householder whether he will take his electricity at 100 or 200 volts. He does not know anything about it; and when he learns what the difference is, by experience, it is too late to raise an objection. Professor Silvanus P. Thompson, being an expert, has declared that, as a consumer, "he would much rather remain on with the 100 volts, unless by some means he could be supplied with 50 volts instead."

In the course of the discussion, some information, new to outsiders, was given respecting the method by which the carbon filaments of the modern incandescent electric lamp are made. Everybody knows what trouble Edison and others had in the early days to procure materials suitable for this manufacture. The filaments were made of bamboo, and of all sorts of fibres. The march of improvement was always in the direction of some preparation of pure cellulose. Now and for some years past almost every lamp in the market has a filament made from a thread of cellulose squirted into a solution of zinc chloride, which solidifies it. For the new 200-volt lamps, the filament is not "flashed" by the carbon-depositing process invented in the early days by Mr. H. S. Maxim. Electrical engineers have now become so used to these flashed lamps, that when they learn from the lamp makers that the process is no longer used for the 200-volt article, they naturally conclude that the latter must be a rough, unfinished brand of goods. It is contended, however, that this is a mistaken view, and that the flashing process was never of any other use than as a means of correcting the raggedness and inequalities of the filaments made by the older methods. When the filament is good in itself, flashing is unnecessary. Mr. James Swinburne is one of those who holds this view; and he is in the company of the President of the Institution, who declares it to be a mistake to think that the lamp filament cannot be made outright as good as the carbon can be rendered by flashing. In the early days, no doubt, there was a great difference between treated and untreated filaments; but by the new process of manufacturing the filaments already described, this difference has been practically removed.

Mr. W. M. Mordey holds that the interest of the consumer in the question of voltage should be more regarded than some central station managers seem to think necessary. He warns his colleagues in the service that a consumer's opinion of what constitutes fairplay to him is not a negligible quantity. He recommends that where, for technical reasons, the supply of current is changed from the lower to the higher voltage, the central station should take on the responsibility of supplying lamps gratis, after the Bradford fashion. "The advantage should not be retained by the supply concerns and the disadvantage left to the consumer." Mr. J. S. Raworth also, while agreeing that central station engineers ought to provide the best system of distributing current with the smallest expense, wanted to give the lamp makers sufficient time to get on with their business on the new lines before the whole country is put upon the high-voltage system. In the course of the discussion, the subject of compound filaments was touched upon. From time to time reports get into circulation promising a new incandescent electric lamp of increased efficiency or emissivity through the addition of something to the ordinary carbon filament. The best opinion and experience agree, however, in dismissing the idea that the filament is at all susceptible of improvement in any such way. Professor Thompson cannnot bring himself to think that lamp makers have come to the end of their resources in the direction of improving the carbon, but does not think there is much hope of improving filaments by coating them with zirconia or other earths. "Some years ago he had assisted at some experiments in Sir William Crookes's laboratory, and had tried coating filaments with every substance they could get hold of; but they had been unable to find any material which at the temperature of the carbon filament *in vacuo* was not either volatilized directly, or else reduced by the reducing action of the carbon and volatilized as metal." This seems to settle the matter.

To conclude: The judgment of many central station engineers is that the distribution of electricity at the higher voltage—say, up to the 250-volt limit allowed by the Board of Trade—is an economical measure that is certain to be taken generally at some time or other, and the sooner the better in the interest of the industry. Meanwhile, neither lamps nor house connections are quite prepared for it. There is no flexible wire in the market which can be trusted at 200 volts. Much of the wiring actually *in situ* could not be considered safe at double the voltage hitherto regarded as the standard. Hence those who desire the change must be content to move with circumspection. Above all, it is desirable not to render consumers hostile. If they get current cheaper in consequence, they will doubtless approve of the change; but this is a deferred effect, only to be realized after a considerable lapse of time. Meanwhile, it is the consumer who has to put up with all the disadvantages, such as they are, of the high voltage lamp; and for this reason it will be preferable, where complaints are general, to "take the bull by the horns" as they have done at Bradford—always supposing, of course, the arrangement is honestly worked, and the consumer is not palmed off with a current-eater he would not buy for himself.

The Mr. Raworth referred to above, recently gave a suggestive address, on some aspects of the supposed immediate future of industrial electricity supply, with which we shall deal in some later issue.

THE HOME OFFICE DEPARTMENTAL WATER-GAS INQUIRY.

THE Commissioners appointed by the Secretary of State for the Home Department for the main purpose of investigating the question of the general distribution of carburetted water gas by gas companies and local authorities have commenced work; but all their proceedings are enveloped in much unnecessary secrecy. We understand that the Commissioners desire that the investigation shall be full and free, and that both the suppliers and opponents of water gas shall have an opportunity for submitting their views. But the best way of making the inquiry complete and conclusive is surely not by the avoidance of publicity. The "JOURNAL" columns are open to the Commissioners; and any communication they may forward to us shall be brought to our readers' notice. The scope of the inquiry is not confined to the distribution of carburetted water gas, but will extend to the various methods of manufacturing water gas, producer gas, &c., for industrial purposes. The Commission consists of Lord Belper (Chairman), Mr. Henry H. S. Cunynghame, Assistant Under Secretary for the Home Office, Dr. Parsons, representing the Local Government Board, Dr. J. S. Haldane, of Oxford, and Professor Ramsay. Mr. J. Pedder is the Secretary to the Commission. The sittings are, we understand, being held from time to time at the Home Office—the first one having taken place about a fortnight ago. Very little has yet been done in the way of examining witnesses; the work so far having been rather of a preparatory nature. The Commissioners have had the system of manufacturing carburetted water gas thoroughly explained to them; and, in order the better to understand its working, they have, we believe, inspected one or two plants. As intimated a fortnight ago, communications have been addressed to the various corporations and companies who supply carburetted water gas, asking if they care to tender evidence; and several well-known gas engineers have already accepted the invitation. The inquiry is likely to last some weeks, after which, it is to be hoped, the Commissioners will make their report with little delay. There seems to be no disposition on their part to hurry the inquiry forward; and this appears to indicate that, as the result of their preliminary investigations, they have not been convinced that there is any urgent necessity for a pronouncement on the subject from them. There is no doubt that the representations which have been made that water gas constitutes such a source of danger to the community that its use should be regulated by law is largely responsible for the inquiry; but it is also suggested that some of the Gas Bills now before Parliament which contain clauses covering the unrestricted supply of carburetted water gas has had some influence in moving the Secretary of State at this particular time.

It is not surprising to learn that gas engineers immediately concerned in the manufacture of carburetted water gas have taken counsel together in regard to their course of action in connection with the inquiry. A conference took place last Friday afternoon at the offices of The Gaslight and Coke Company, and nearly every gas undertaking interested in the question was represented. The proceedings were of a private nature; but we are in a position to say that the joint experience of those present fully demonstrated the safety of carburetted water gas in practical use, and they were in harmony as to there being no grounds or justification for any limitations being imposed in connection with its supply. So far as we can learn, no formal resolution was passed as to concerted action being taken; but there is no doubt that those who are responsible for the management of the various undertakings represented will arrange for their experience to be laid before the Commission in due course.

MANUFACTURE OF CARBIDE OF CALCIUM AND ACETYLENE.

ACETYLENE was under discussion last week at two gatherings of technical men in London. At the meeting of the London Section of the Society of Chemical Industry on the Monday Mr. Roger W. Wallace, Q.C., read a paper on the "Electrical Industries at the Foyers Waterfalls." The manufacture of calcium carbide at Foyers is an industry only second in importance to that of aluminium; and many of Mr. Wallace's large audience no doubt were attracted to the meeting in the hope of hearing something as to the present position of carbide manufacture in this country. In this hope they were grievously disappointed. Mr. Wallace gave an excellent historical review of the manufacture of aluminium, and many interesting details of the resources of the British Aluminium Company, which owns the Foyers water-power. Several good photographs of the country between Loch Ness and Loch Garth, and of the tunnel, turbines, and dynamos erected there were exhibited. Drawings of some familiar types of carbide furnaces—such as those used at Niagara—were shown; but no particulars as to the manufacture of carbide at Foyers were given. Mr. Wallace considered that the almost contemporaneous reading of another paper (to which we refer below), dealing with calcium carbide and acetylene, rendered it altogether unnecessary for him to complete his paper by treating of the carbide industry. This view he persisted in; and when he came to reply to the discussion on his paper, he ignored references that were made to calcium

carbide, and only reiterated a vague and unsubstantiated remark to the effect that acetylene was not more dangerous than coal gas. In the light of this statement, it seems likely that Mr. Wallace could have told his audience little of value about acetylene; but certainly there prevailed a very general feeling of disappointment when he announced that he had excised the portion of his paper dealing with calcium carbide. One interesting item of information was, however, vouchsafed—viz., that the cost of power at Foyers to the British Aluminium Company is "not far from" thirty shillings per electrical horse power per annum; but that the Company would not be prepared to let any of its surplus power to others for less than four pounds per E.H.P. per annum.

The paper on "Calcium Carbide and Acetylene" by Mr. Henry Fowler, Assoc.M.Inst.C.E., which was read at the meetings of the Institution of Civil Engineers on the 8th and 15th inst. (see p. 646), and of which the discussion will be resumed at to-day's meeting (the 22nd) was in every way an excellent contribution to technical literature. Mr. Fowler has carried out, under the instructions of Mr. J. A. F. Aspinall, M.Inst.C.E., of the Lancashire and Yorkshire Railway Company, a number of experiments on the use of acetylene as an enricher of oil gas for railway carriage lighting. The acetylene was produced from Neuhausen carbide, 1 lb. of which yielded 4758 cubic feet of the gas. This quantity was mixed with oil gas, so that the mixture contained about 13·4 per cent. of acetylene. The illuminating power of the mixture was only 6 candles higher than that of the oil gas; and Mr. Fowler concluded that the acetylene had an enrichment value of about 87 candles.

Experiments were also made with various mixtures of oil gas and acetylene, in the same manner as those recently made in Berlin by Herr Gerdes. The "JOURNAL" record of these tests (Vol. LXIX., p. 1248) had evidently been freely used in the compilation of some tables displayed by Mr. Fowler. One object of the experiments appears to have been to discover a burner which would furnish a light of about 20 candles by the consumption of acetylene or mixtures rich in that gas, as a light of 20 to 25 candle power is amply sufficient for the proper illumination of a railway carriage. In this quest, Mr. Fowler was really unsuccessful, as the only burner which gave at all satisfactory results was a small one of the air-injector type; and this was so wofully wasteful of the illuminating power of acetylene that at a consumption of about half a cubic foot per hour, the candle power per 5 cubic feet worked out at only 91·5. Mr. Fowler stated that only with large burners, giving an illuminating power of about 40 candles, could so high a duty as 200 to 240 candles per 5 cubic feet of acetylene be obtained.

In the course of the discussion on the paper, it was pointed out that 240 candles did not represent the highest duty obtainable from the gas, as Herr Wolff has recently secured as much as 278 candles per 5 cubic feet, as recorded in the "JOURNAL" for March 1 (p. 479).

The general description of calcium carbide and acetylene given by Mr. Fowler was an excellent *resumé* of all that has been hitherto published. He was not, however, in touch with the manufacturers of carbide in Great Britain; and therefore his paper contained none of the information concerning the carbide industry at Foyers which Mr. Wallace might have given in his paper had he been less diffident, and less fearful of trenching on the ground covered by Mr. Fowler. We hope at an early date to offer some further remarks on the latter gentleman's paper, and on the discussion thereon.

APPLICATION FOR A COMPULSORY LICENCE UNDER THE PATENTS ACT, 1883.

ABOUT a year ago, the usual grumbling against the British system of patents for inventions came to a head in a particular regard. It was loudly complained that under the Act of 1883 foreign patentees were able to close the manufactories of the United Kingdom to their processes; and when it was observed that by the Act there is due provision made for compelling patentees to grant licences, the objection was taken that nobody had thought it worth while to make use of the provision. The critics of the Act went so far as to style the provision in question a "dead letter;" but inasmuch as they were fain to confess they had never tried to set it in operation, the Board of Trade demurred to this judgment. The provision is contained in section 22 of the Act, which runs thus: "If, on the petition of any person interested, it is proved to the Board of Trade that, by reason of the default of a patentee to grant licences on reasonable terms, (*a*) the patent is not being worked in the United Kingdom, (*b*) the reasonable requirements of the public with respect to the invention cannot be supplied, (*c*) any person is prevented from working or using to the best advantage an invention of which he is possessed, the Board may order the patentee to grant licences on such terms as the Board may deem just." When complaint was made to the Board of Trade of the exclusiveness of foreign patentees, the official reply was that the complainants ought to show that this clause had been tried and found wanting before condemning the whole British patent system.

Curiously enough, the first time that the section was put into operation was not by a British complainant of foreign exclusiveness, but by a German firm desiring to make use of the patented process of an English trading and industrial Company. Application was made under the section to the Board of Trade by the Continental Gas Glühlight Actien Gesellschaft, vormals Kroll, Berger, and Co., for a compulsory licence, under the patents of the Incandescent Gas-Light Company, to manufacture Welsbach mantles for use with oil-lamps of the "incandescent" type. This being the first proceeding of the kind, the precedent was carefully considered on all sides. Mr. Roger Wallace, Q.C., was appointed to hear the application in his capacity of Counsel to the Board of Trade; and the proceedings have already spread over six days, without arriving at a definite result. The position of the parties, as represented by the "Engineer," from which account this summary of the proceedings is prepared, was that whereas the respondents, as owners of the Welsbach patent rights for incandescent mantles, favoured exclusively a particular make of incandescent oil-lamp, the petitioners claimed to be the owners of a better one. The Incandescent Gas-Light Company's oil-lamp patents were those of Graetz (No. 14,844 of 1892) and Moeller (No. 4235 of 1895). The applicants based their claim upon a patent (No. 24,083 of 1896) of German origin, applied for in this country by Messrs. W. P. Thompson and Co. It is obvious that here are all the elements of an interesting struggle. The gist of the applicants' contention was that, as they needed Welsbach mantles for their oil-lamp, they should be permitted to make them under compulsory licence, and that the Incandescent Gas-Light Company should not be allowed to exclusively favour another, and alleged inferior, make of oil-lamp for use with their mantles.

Judgment is reserved; and we cannot therefore discuss the merits of the case. It is considered by our contemporary, however, that the proceedings, so far as they have gone, make it clear "that the compulsory powers of the Board of Trade will only be exercised in the case of inventions of considerable value, for which it is apparent that there exists, or can be developed, a real public demand which is not being met by existing arrangements. It is also clear that the *bona fides* of the applicant, and his financial and other status, must be perfectly satisfactory in all respects if the Board of Trade is to be (successfully) moved to intervene on his behalf." Counsel for the applicants in this case were Mr. Bousfield, Q.C., and Mr. Jenkins, Q.C.; for the respondents, Mr. J. Fletcher Moulton, Q.C., Mr. Terrell, Q.C., and Mr. Walter. The experts engaged were, for the applicants, Mr. Boverton Redwood and Mr. James D. Roots; for the respondents, Mr. Dugald Clerk and Mr. James Swinburne.

SIR HENRY BESSEMER AND HIS WORK.

THE death of Sir Henry Bessemer last week at the ripe age of eighty-five should not be passed over without notice by an engineering journal. It is as one of the creators of the modern Steel Age that Bessemer will be chiefly remembered by the engineers of future ages, whatever may be their predominant characteristic; but we desire to commend his great career to the study of our younger readers, rather as exhibiting what it is to be an inventor, in the fullest sense of the term. Bessemer would still have been a wonderful phenomenon, a grand example of the motive power of the individual, if he had never made a pound of steel. Somebody has said that the best university is a book. It would be more just to say that every modern industry is, in the last resource, a man. All human occupations, if we could trace them to their beginnings, would be found to originate in invention. It is a commonplace of criticism to remark that few men have done more for their kind than the unknown genius who made the first wheelbarrow. To complete the statement, however, it should be added that the maker of the original wheelbarrow probably drove it himself. He felt the want of the appliance, he supplied the want, and then made use of it. Herein lies the secret of really productive Invention. The point is worth making, because there has sprung up in later times a pernicious way of regarding Invention merely as the making of a "lucky hit." This way of approaching the subject is encouraged by the trashy periodicals that are published in all manufacturing countries ostensibly in the interest of "inventors," or to aid "mechanical progress," but are really traps by which the unwary person with a turn for "inventing things" is made the prey of sharpers of various descriptions. We had occasion some time ago to denounce one of these publications for holding before the eyes of ingenuous youth the ideal of "inventing something" as a means of escaping from the necessity of honestly working for a livelihood. A more immoral and degrading view of the office of the inventive faculty was never promulgated. Happily, the great examples of inventors like Bessemer, who is gone at last to his well-earned rest, and Siemens, Maxim, Mond, and a host of others who might be named, exist to correct this pernicious error, and to show that the true way of Invention is one of the hardest and most exacting labour. These are men whose life-story is to be studied for the stimulus it cannot fail to give to those whose desire is to help their generation as well as to advance themselves.

Bessemer was an indefatigable worker; but he had for his birthright a touch of imagination which enabled him to see a little farther than it is given to most men to look into the needs

of mankind. Of course, he had his suggestive "accidents," and made several "lucky hits." Lord Beaconsfield observed that "Adventures are to the adventurous." Charles Dickens used to say that, in the course of his walks abroad, he was always meeting odd characters and becoming involved in humorous incidents. Bessemer was one of the men to whom suggestions for new inventions come from all sides. He has himself told—for he was fond of talking over his life of struggle and endeavour—how nearly his first considerable success came to checking his progress, and perhaps depriving the world of all the riper fruits of his creative genius. He was the first to provide the Government with a mechanical means of rendering stamp frauds impossible. Previously to his invention, the national revenue suffered heavily by the fraudulent practice of making old stamps do duty over again; but Bessemer stopped this once for all by his expedient of inserting moveable date-pins in the stamp-dies. He was to have been rewarded by a post in the Stamp Office; but a change of Government occurred at what appeared to be an inopportune time for him, and he never obtained it.

Bessemer was a poor man, and he felt the ingratitude of the Government keenly in more than one way. While still smarting under the sense of injustice, a trivial incident suggested to his inquiring mind that there might be "something in" the gold paint at that time sold for artists' use. He discovered that the retail price of this pigment was 7s. an ounce, which was clearly too little for gold, and too dear for any base metal alloy. The cost was chiefly due to the method of preparing the gold bronze powder from Dutch foil. Bessemer went into the matter, worked out a means of making the gold paint to great advantage, and began to supply the market with it as a proprietary article. The process was never patented, and for years it was worked in secret personally by the inventor and his sister. It is not a little remarkable that the man who was in the course of his life to pay £10,000 in patent fees, without ever having to fight a patent case, should have made his first fortune by a secret manufacture. The circumstance, however, is full of instruction of its own for those inventors—and they are not few—who are disposed to compare the advantages of the two ways of retaining the property in an invention. These are: Patenting it; and working it as a secret process. There is no third course. Through the patent law, the community grants protection to the property of a patentee in his invention, for a limited period, upon certain conditions, the most important of which is that he shall so publish the nature of his invention and the manner in which he proposes to carry it into effect, that at the expiration of the period of protection the public may have the full benefit of his ingenuity. If, on the other hand, the inventor elects to keep his own counsel, he does so at his peril. There are fewer secret manufactures, and more patented inventions, every year; and for obvious reasons. Few manufacturing secrets that are worth anything can long resist the curiosity of the interested public. Bessemer's secret was kept because it happened to be peculiar in several important respects. The trade was done in a small, quiet way, and did not attract the cupidity of possible rivals. The public only saw that Bessemer gold paint was both cheap and good. The manufacture could be kept in the hands of at most two or three people, none of whom was open to temptation to betray the secret. The secret itself was not of composition (when it would have been at the mercy of analysis by any purchaser), but lay in the preparation. For these sufficient reasons the Bessemer gold paint process returned to its prudent proprietor the handsome profit of £40,000, before he parted with it as a gift to the faithful workman who had during the later years carried it on.

The discovery of the way to make steel directly from cast iron, by the simple device of blowing air through the molten metal and so burning out the excess of carbon and combustible impurities whose presence distinguishes one form of the metal from the other, was no "lucky hit." Bessemer has recounted how at the little yard in Kentish Town he worked out his process; and it is matter of history that the ironmasters of that day were arrayed against the presumptuous outsider who pretended to be able to teach them how to make steel for about one-quarter of the usual cost. It is worthy of notice that some contemporary civil engineers saw the value of the process from the first. George Rennie was greatly struck by it, and prevailed upon Bessemer to bring his "wonderful invention" before the British Association, at the Cheltenham meeting of 1856. Then a remarkable thing happened. Nasmyth recognized the character of the invention, and within a month of the reading of the paper five ironmasters had paid £27,000 for licenses under Bessemer's patent. But this was a false start. The licensees were not enterprising enough to grapple with the difficulties incidental to a proposal to turn a great staple industry upside down. Other iron manufacturers set up what they understood to be Bessemer plant, with a view to experiment. But they did not desire its success; and therefore naturally the process failed in their hands. Bessemer and his partners could do nothing in the face of this half-heartedness and downright opposition; and the firm came to the conclusion that if Bessemer steel was ever to be made, they must make it themselves.

This is the history of all real inventions of magnitude. The inventor thinks he has only to acquaint a manufacturer with the fact that there is a way by which his product can be put upon the market for a fourth of the usual price, to have his advice and assistance eagerly taken. But things do not happen so. The manufacturer is quite content to go on charging the usual prices, paying the accustomed cost of production, and pocketing the regular profits. He does not wish to have his business upset by every pestilent enthusiast who comes to him. Show him how to save 5 per cent. here or there, and he will pay for the assistance; but industrial revolutions have no attractions for him. He does not believe in their possibility, for one thing; and if they are possible—well, somebody else may have all the benefit of them!

Thus it was that the firm of Henry Bessemer and Co. went into the steel business, just as Frederick Siemens was driven to make glass in order to find employment for his regenerative gas-furnaces. For more than two years Henry Bessemer spent his money, and exercised his ingenuity, in perfecting his process; and in due course his firm were able to place upon the market steel as good as any that could be bought of the older makers, at a reduction of £20 per ton. Then Sheffield awoke to the fact that it was being undersold; and Bessemer licenses were sought for afresh. They were now only to be had at a price greatly superior to the original terms. Moreover, the firm had the luminous idea of dividing the country into districts—planting one licensee in each. Thus they divided their favours, while creating a number of interests which were worth cultivating. In 14 years the royalties taken by the firm amounted to upwards of a million sterling.

To say this, however, is only to show one side of the picture. The success of the Bessemer process threw steel open to the industrial world. Before his time, steel was for tools, for small ordnance, and for other uses in regard to which cost was immaterial. Bessemer made all the railways of the world anew; and every railway coach and truck ran upon his tyres. Consequently, he cheapened the bread in the mouths of his countrymen. If American wheat comes into England in vast and enormously increasing quantities year by year, it is almost wholly due to the Bessemer steel rail. The indirect effects of the Bessemer triumph have been almost greater than the direct benefits. It made the way easy for the open-hearth and the basic processes of steel manufacture. Bessemer broke down the old exclusiveness of the steel makers; and the new order came in easily enough upon the track of the innovator. Modern steamships, gasholders, and railway bridges may not be made of Bessemer steel; but certainly without Bessemer they would hardly have come into existence.

Bessemer was an example of the reluctance of genius to submit to the classifications that serve to differentiate ordinary men. He was not an engineer, in the strict sense of the term; he was no chemist; of physics he knew little; and the greatest failure of his life—the steamship *Bessemer*—exhibited his lack of training in several sciences with which many undistinguished persons are familiar. It is impossible to account for such men. They appear every now and again, like comets in the industrial firmament, to confound all our categories, and make our technical education systems look foolish. We can but be thankful for them, and so study their great examples that, if we cannot be sure of emulating their renown, we may profit by their experiences, and avoid their mistakes.

THE HEAT DEVELOPED DURING PURIFICATION BY MEANS OF WELDON MUD.

ATTEMPTS have been made in the "JOURNAL" for the 15th ult. and 15th inst., to deduce from thermo-chemical data the amounts of heat which may conceivably be liberated during the fouling and subsequent revivification of oxide of iron. From the results of the computations of the heat liberated, the temperatures which might supervene in oxide purifiers during use, and in the revivifying mass, were calculated. The natural limitations of the methods of computation which were used were recognized and indicated. It was, however, stated that even the necessarily inexact calculations made might be of considerable service. An instance of the application to useful ends of the rather academical reasonings and speculations indulged in in the articles referred to, may now be offered.

It has frequently been asserted, in general terms, that the affinity of the manganese dioxide of Weldon Mud for sulphuretted hydrogen is more marked than that of the ferric hydrate of bog oxide for the same gas; and that both in fouling and revivification, Weldon Mud acts more vigorously than bog oxide. The statements as to the relative vigour of the action of Weldon Mud and oxide appear to have been based chiefly on rough observations of the temperatures which arise during the fouling and revivification of the materials under working conditions, or in laboratory trials in which the latter conditions were as nearly as possible simulated. Apart from the fact that the methods of observation usually consisted merely in applications of the hand to the material or to the exterior of the containing vessel, or at best in the insertion of a thermometer in masses of uncertain dimensions and degrees of dampness, reasonable objection may be taken to the rough-and-ready practical test, on the ground that it affords no guarantee that the materials were tested under conditions equally favourable to both. For instance, a special preparation or condition of one material may have enabled it to take up its full complement of sulphuretted hydrogen, while the physical state of the other material precluded such thorough interaction. In such a case,

the real capabilities of the materials would not be fairly gauged, as by slight variations in the density or degree of fineness and moistness of one of the materials results of trials might be completely changed. It is therefore desirable that the intrinsic value of the active ingredient in each material, in the proportions in which it usually occurs therein, should be ascertained, in order that the merits of the materials may be compared apart from readily variable conditions. The thermic effects of the several reactions afford a reliable gauge of the vigour with which they proceed. In order to make a comparison of the vigour of the action of sulphuretted hydrogen on Weldon Mud and on bog oxide, we now purpose making a computation of the temperature which may supervene from the reactions which occur during the fouling and revivification of Weldon Mud.

Weldon Mud, as delivered to gas-works, is a bulky black powder, containing about 54 per cent. of uncombined water, and about 26 per cent. of manganese dioxide. Gas managers prefer to store it until it has lost some portion of its large content of water; and we will assume that the mud, as put into the purifiers, contains only 40 per cent. of water. We shall not then err by under-estimating the possible thermic effects of the reactions. The percentage composition of the Weldon Mud will then be about as follows: Manganese dioxide, 34; water, 40; manganese monoxide, calcium chloride, lime, and other unessential ingredients (which may for the sake of brevity be termed impurities), 26. We will take it that the manganese dioxide is the only active ingredient, since it is on the basis of its content of this substance that Weldon Mud is bought and sold for gas purification; and after the first fouling the other ingredients are inactive. We will also assume, as in the case of bog oxide, that the percentage of moisture in the material is not increased or decreased by the simple passage of gas through it. Sawdust and wood chips are not added to Weldon Mud before it is put in the purifiers. The course of the reaction between Weldon Mud and sulphuretted hydrogen does not appear to have been investigated in the same manner as that between ferric hydrate and sulphuretted hydrogen was by Mr. Lewis T. Wright. The reaction, so far as the ultimate products are concerned, may probably be fairly represented by the equation

$$Mn O_2 + 2 H_2S = MnS + S + 2H_2O.$$

Assuming that this reaction occurs, 100 parts of Weldon Mud, as put into the purifiers, will have become, when completely fouled, about 126·6 parts of a material consisting of 40 + 14·1 = 54·1 parts of water, 34 parts of manganese sulphide, 12·5 parts of sulphur, and 26 parts of the original impurities. This change will have been effected by the agency of 26·6 parts of sulphuretted hydrogen. We will assume, as in the case of bog oxide, that the gas entering the purifier contains on an average 1·2 per cent. by volume of sulphuretted hydrogen, which is equivalent to 755 grains per 100 cubic feet. This volume of gas weighs about 3·7 lbs., or 25,900 grains; and therefore the weight of the gas which passes out from the purifier is about 33·5 times that of the sulphuretted hydrogen retained by the Weldon Mud. Consequently, for every 100 parts of Weldon Mud fouled 26·6 × 33·5 = 890 parts (by weight) of gas pass over it.

We have throughout ignored water of hydration, both of the dioxide and of the sulphide, with the object of simplifying the calculations. The calorific effects given below are, however, for these bodies in their customary states of hydration, though again, for simplicity of statement, we shall speak only of the dioxide and sulphide, without specifying the degree of hydration. Then the combination of 55 parts of manganese with 32 parts of oxygen, to form 87 parts of manganese dioxide, has a calorific effect of 116,280 calories. The combination of 55 parts of manganese with 32 parts of sulphur, to form 87 parts of manganese sulphide, has a calorific effect of 46,370 calories. The combination of 2 parts of hydrogen with 32 parts of sulphur, to form 34 parts of sulphuretted hydrogen, has a calorific effect of 4740 calories. The combination of 2 parts of hydrogen with 16 parts of oxygen, to form 18 parts of water, has a calorific effect of 68,360 calories.

We can now compute the net calorific effect of the changes which occur during the fouling of 100 parts of Weldon Mud. To dissolve the union of manganese and oxygen in 34 parts of manganese dioxide, and the union of hydrogen and sulphur in 26·6 parts of sulphuretted hydrogen, will require the expenditure of the following number of calories:—

$$\frac{34 \times 116{,}280}{87} = 45{,}443$$

$$\frac{26{\cdot}6 \times 4740}{34} = 3{,}647$$

Total. . . 49,090 calories.

The formation of 34 parts of manganese sulphide, and 14·1 parts of water, will liberate the following number of calories:—

$$\frac{34 \times 46{,}370}{87} = 18{,}122$$

$$\frac{14{\cdot}1 \times 68{,}360}{18} = 53{,}435$$

Total . . . 71,557 calories.

The net result, therefore, of the fouling is the liberation of 71,557 − 49,090 = 22,467 calories.

The rise of temperature may then be readily calculated, by finding the weight of water equivalent to the substances which are affected by the heat liberated, thus—

	Parts.		Specific Heat.		Equivalent in Parts of Water.
Manganese sulphide . . .	34·0	×	0·175	=	5·95
Sulphur	12·5	×	0·200	=	2·50
Water	54·1	×	0·000	=	54·10
Impurities	26·0	×	0·200	=	5·20
Coal gas	890·0	×	0·550	=	489·50
			Equivalent in water	=	557·25

The rise in temperature of the Weldon Mud will therefore not exceed 22,467 ÷ 557·25 = 40·3° C. Assuming that the initial temperature in the system was 15·5° C. (60° Fahr.), the temperature attained by the mud during fouling will be 55·8° C., or about 132° Fahr.

We will next compute the temperature which may arise during the revivification of the completely fouled Weldon Mud. The oxygen necessary for the conversion of 34 parts of manganese sulphide to 34 parts of manganese dioxide would be 12·5 parts; and this would be associated in the atmosphere with 41·5 parts of nitrogen. By the process of revivification, 12·5 parts of sulphur would be liberated from 34 parts of manganese sulphide. The revivified material derived from 100 parts of Weldon Mud by complete fouling and complete revivification, would therefore consist of 34 parts of manganese dioxide, 25 parts of sulphur, 54·1 parts of water, and 26 parts of impurities. From 100 parts of Weldon Mud, 139·1 parts of revivified material will have been derived, if it is assumed that no evaporation or condensation of water has occurred during fouling and revivification,

To dissolve the union of manganese and sulphur in 34 parts of manganese sulphide will require the expenditure of

$$\frac{34 \times 46370}{87} = 18{,}122 \text{ calories.}$$

The formation of 34 parts of manganese dioxide will liberate

$$\frac{34 \times 116280}{87} = 45{,}443 \text{ calories.}$$

The net result, therefore, of the revivification will be the liberation of 45,443 − 18,122 = 27,321 calories.

The equivalent in parts of water of the substances on which this heat can take effect, may then be found thus—

	Parts.		Specific Heat.		Equivalent in Parts of Water.
Manganese dioxide . . .	34·0	×	0·175	=	5·95
Water	54·1	×	1·000	=	54·10
Sulphur	25·0	×	0·200	=	5·00
Impurities	26·0	×	0·200	=	5·20
Nitrogen	41·5	×	0·244	=	10·13
			Equivalent in Water	=	80·38

Therefore the equivalent of 80·38 parts of water will be affected by 27,321 calories; and the rise in temperature of the mass will be 27,321 ÷ 80·38 = 340° C. nearly. Assuming that the mass originally stood at 15·5° C. (60° Fahr.), the temperature attained would be 355·5° C., or 640° Fahr. But before so high a temperature was reached, water would be evaporated from the mass, and heat would thereby be abstracted from it. More heat than the 27,321 calories available would be needed to evaporate the whole of the 54·1 parts of water present. But by the method of calculation adopted in the investigation of the heat of revivification of bog oxide, which is sufficiently exact for the present purpose, we shall see that about 39·75 parts of water may be evaporated, and the temperature of the material remain as high as 100° C. Thus the heat required to evaporate 39·75 parts of water at 100° is 39·75 × 537 = 21,346 calories. There will therefore be available for raising the temperature of the system 27,321 − 21,346 = 5975 calories. In place of 54·1 parts of water, we have—

	Parts.		Specific Heat.		Equivalent in Parts of Water.
Aqueous vapour	39·75	×	0·480	=	19·08
Water	14·35	×	1·000	=	14·35
Total				=	33·43

Substituting this figure for 54·1, we find the equivalent of the material, and nitrogen and aqueous vapour, to be 59·71 in place of 80·38. Then the temperature attained will be 5975 ÷ 59·71 = 100° C. nearly, or 212° Fahr.

Hence it appears that the fouled Weldon Mud contained sufficient water to prevent the temperature of the mass rising above 212° Fahr., and that, supposing evaporation did not take place below this temperature, a surplus of 14·35 parts of water would remain in the material. Under these conditions, the mass could not possibly take fire through the heat evolved during revivification. After the material had fallen to the ordinary temperature of 60° Fahr., through the further evaporation of water, it would have the following approximate composition: Manganese dioxide, 34 parts; sulphur, 25; water, 5; and impurities, 26. Thus the original 100 parts of Weldon Mud will have been reduced by loss of water to about 90 parts of revivified material. The revivified material will contain about 28 per cent. of sulphur and 38 per cent. of manganese dioxide.

Practical trials of Weldon Mud bear out these figures, and show that the reactions virtually extend to every particle of the manganese dioxide in it. Indeed, to obtain as low a proportion

of sulphur as the above on the once fouling and revivifying of Weldon Mud of the composition we are dealing with, needs special precautions against revivification *in situ* through traces of oxygen in the gas, and against reactions occurring between the sulphuretted hydrogen and the materials we have classed together as impurities of the Weldon Mud. Without such special precautions, or with drier Weldon Mud, it is quite easy to obtain once fouled and revivified material which, after drying, contains over 40 per cent. of sulphur. We wish here to judge the Weldon Mud solely on the activity of the manganese dioxide—which, as already remarked, is the constituent on which its commercial value is assessed—and the phenomena of continuous revivification must also be excluded from the calculations. Under such circumstances, it appears that Weldon Mud containing, in the first instance, 40 per cent. of water will, in virtue of the activity of its manganese dioxide, yield on its first fouling, revivification, and drying a material containing about 29·4 per cent. of sulphur. If this revivified material be brought, by the addition of water, to its original degree of moistness before being put into the purifier a second time, it will contain about 17·6 per cent. of sulphur and about 25·2 per cent. of manganese dioxide.

In a subsequent article, we purpose using the figures obtained above, and in the articles on oxide already referred to, for the purpose of instituting a comparison of the intrinsic merits of Weldon Mud and bog oxide for the removal of sulphuretted hydrogen from coal gas. The extent to which each of these substances owes its practical success to its physical state rather than to its chemical composition, will then be briefly considered.

PERSONAL.

At the meeting of the Hinckley District Council last Tuesday, Mr. G. HELPS, who has left the service of the Council to take charge of the Nuneaton Gas-Works, was engaged as Consulting Engineer, for the purpose of carrying out the extensions at the gas-works for which he has prepared the preliminary plans. The outlay will come to nearly £10,000; and Mr. Helps will receive a fixed sum for his assistance.

Mr. R. YOUNG, the Manager of the Laurencekirk Gas Company's works, has been appointed Manager of the Lockerbie Corporation Gas-Works. Mr. Young's father was for many years the Manager of the gas-works at Newmilns, in Ayrshire. A few weeks ago it was announced that Mr. J. Bruce, of Lochgilphead, had received the above appointment; but he has decided to retain his present position.

The Meeting of the Societe Technique takes place this year earlier than usual. It will be held on the 20th prox. and following days at Nice, under the presidency of M. Ph. Delahaye, who, it may be remembered, was re-elected at the meeting held in Paris last June. On the evening of the first day, the members will be invited to a banquet by the local Gas and Electricity Company, whose works will be visited later in the week. On the 22nd there will be an excursion to Monaco.

Acetylene Gas as a Motive Power.—The "Auto-Car" recently referred to some experiments conducted at Compiègne on the motive power of acetylene gas. It was found that this gas develops fully three times the energy of illuminating gas, and that the only change needed to transform an ordinary gas-engine into an acetylene-engine is a reduction in the size of the intake valves. The best mixture seems to be ten of air to one of gas. With these proportions it was found that engines ranging from 8 to 16 horse power cost about 6 c. per horse power per hour at the present cost of calcium carbide.

The Petroleum Committee.—A Select Committee of the House of Commons has been appointed to inquire into and report upon the sufficiency of the law relating to the keeping, selling, using, and conveying of petroleum and other inflammable liquids, and the precautions to be adopted for the prevention of accidents with petroleum lamps. Sir T. Gibson-Carmichael, Mr. Jesse Collings, Mr. A. Cross, Mr. Fortescue Flannery, Sir E. Hill, Mr. Kenyon, Mr. Macdona, Mr. M'Killop, Mr. J. A. Pease, Mr. Pollock, Mr. Harold Reckitt, Mr. Compton Rickett, Sir B. Stone, Mr. Tully, and Mr. Ure are members of the Committee.

Midland Gas Managers and the Tar Distillers.—Owing to the unsatisfactory treatment received by the managers of gas-works in the neighbourhood of Derby from certain tar distillers, a movement has been set on foot for the establishment of a tar distillery, to be worked by a representative Committee from the various undertakings, or for the sale of the products collectively. The first meeting was held on the 11th inst. at the Midland Hotel, Derby, when a good number of representatives attended. Mr. F. C. Humphrys, of Ilkeston, was appointed Chairman; and Mr. J. Andrews, of Langley Mill, Secretary. It was resolved: "(*a*) That this meeting of representatives of gas undertakings considers it advisable to dispose of their surplus tar and liquor collectively. (*b*) That the same be offered by advertisement on approved form of tender. (*c*) That tenders be delivered to the Chairman, sealed and endorsed, and opened at the next meeting of representatives." There is perfect unanimity among those who have associated themselves in this enterprise; and as they represent the bulk of the produce in the neighbourhood, they hope to enrol every concern.

NOTES.

Heat of the Reaction between Water and Calcium Carbide.

Some experiments have been made at the Imperial Physical Technical Institute at Charlottenburg to determine the rise in temperature when calcium carbide is decomposed by a large excess of water. Neuhausen carbide was used, and a known weight of it was agitated in the determined quantity of water in an open vessel. During the first minute the evolution of gas was tumultuous, and the rise in temperature very rapid; but afterwards the evolution went on quietly, and the temperature began to fall. The following are some of the more important of the figures obtained:—

Grammes of Water Taken.	Grammes of Calcium Carbide Taken.	Rise in Temperature. Degrees Centigrade	Corresponding Number of Calories Liberated.	Number of Calories Liberated per Gramme of Calcium Carbide.
200	10	15·8	3160	316
150	15	25·9	3885	259
100	20	49·5	4950	248
100	30	65·7	6570	219

Weakness of Cast-Iron Columns.

Some remarkable results of full-size tests of cast-iron columns as commonly used in buildings in New York are published in the "Engineering Record." The local building law provides that the working load for cast-iron columns shall not exceed one-fifth of the ultimate resistance; both results being calculated from accepted formulæ depending upon the ascertained crushing strength of cast iron in small tests blocks. Doubts having arisen, consequent upon some disastrous failures, as to how far the presumptions of these computations are justified in fact, the city authorities had a number of full-sized columns tested to destruction by the celebrated presses of the United States arsenal at Watertown. Generally, the results exhibited very much more weakness in the column castings than was expected. Some of the columns, 5 and 8 inches in diameter, were 20 diameters long; others being 13 diameters long. Though in the tests every precaution was taken to ensure central loading—which cannot be done in ordinary building construction—it was found that the breaking strength of the iron in the columns was only about one-third that usually ascribed to it on the faith of text-book data derived from the crushing of small blocks. The results go to show that, instead of cast-iron columns in building construction having a factor of safety of 5, it may be as low as 2·9; while if the effect of unequal loading is taken into account, it may be non-existent. The suggestion is that cast-iron columns should not be permitted in modern building construction.

Naphthalene Stoppages.

The old and almost universal grievance as to naphthalene obstructions has lately formed the subject of some investigations by a firm at Baden; and a notice of them has appeared in the "Zeitschrift für Gas-und Wasser-fach." A distinction is drawn between the methods of combating stoppages, according to whether a simple solution or the complete suppression of the naphthalene is aimed at. The best solvents are the very volatile hydrocarbons which evaporate very rapidly. These are frequently applied to remove stoppages at the inlet mains of gas-holders, and have the effect of transferring and disseminating the naphthalene. By the usual method of shutting off the main, pouring in the solvent, and at the expiration of about an hour bringing it to the surface, where the liquid evaporates, the naphthalene is not actually suppressed, but recrystallizes in the holder. The method answers well, however, for the cleansing of the main. The suppression of naphthalene is a more difficult matter. Spirit, petroleum ether, and hylol have really no special value for the purpose; as, apart from the fact that they are less volatile, they take up only about a fifth as much naphthalene. Toluol appears to be the best medium; and therefore carburetting benzol, which contains a considerable amount of toluol, is very valuable for suppressing naphthalene. Practical trials have shown that stoppages in street-lamp services are most simply avoided and removed by strongly carburetting the gas with benzol. Spirit appears to give very conflicting results as a preventative of naphthalene obstructions.

Steam-Boiler Explosions in 1897.

Every parliamentary session there is an attempt made in the Trade Union interest to legislate in favour of the compulsory licensing of steam engine and boiler attendants, of course ostensibly in the interest of public security. The official report of the Board of Trade on the working of the Boiler Explosions Act for the past year does not furnish any evidence to support the theory that any good purpose would be served by placing steam users under this bondage. The number of explosions covered by the report was 80; the number of lives lost, 25; and of the injured, 75. Only 23 of these explosions were held to require formal investigation. The general impression created by the report is that the minimum of explosions has been reached, and that those which occur are, as a rule, due to causes which are likely to continue to operate so long as human nature and the materials of boiler construction remain what they are. Of the whole number of explosions recorded, only 12 were ascribed to

the ignorance or neglect of the attendants; while 33 were due to defective design, workmanship, or material, or to excessive pressure; and 28 were attributable to corrosion, or to defects in the safety-valves or fittings. An examination of the dozen cases, moreover, does not, according to the "Engineer," much strengthen the argument in favour of certificates for boiler attendants. In several instances, the culprit was a marine engineer, holding a Board of Trade certificate. In more than half of these cases there is no evidence to show that an examination and a certificate would have been of any avail; while the remaining five instances are doubtfully chargeable to the attendants at all.

TECHNICAL RECORD.

CALCIUM CARBIDE AND ACETYLENE.

At the Ordinary Meeting of the Institution of Civil Engineers last Tuesday evening, a paper on the above subject was read by Mr. H. Fowler, Assoc.M.Inst.C.E.

The author began by stating that acetylene was first isolated by E. Davy in 1837 from potassium carbide—a bye-product of Sir H. Davy's method of manufacturing potassium. In the middle of the century, Berthelot investigated its properties; and Wöhler produced it from calcium carbide. During the past few years it has assumed commercial importance, owing to the development of the electric furnace, in which calcium carbide can be readily produced from lime and carbon. This carbide is unacted upon by most of the ordinary re-agents; but it is rapidly decomposed by water into acetylene and lime, giving 5·9 cubic feet of acetylene, at a temperature of 60° Fahr. and a pressure of 30 inches of mercury, per pound of carbide. As the power required theoretically to produce 1 lb. of calcium carbide in an electric furnace is more than 2 horse-power-hours, its manufacture is at present restricted to localities where power is cheap, as for instance where water power is available.

Acetylene is a colourless gas, with an intensely penetrating odour, and is slightly soluble in water, and extremely so in some other fluids. It is endothermic, giving 407 calories per cubic foot, whereas theoretically its value is 336·5 calories. As an illuminant it affords the most brilliant light of all gases; 5 cubic feet per hour under suitable conditions giving 240-candle power. For small consumptions, however, this value is not obtained; and ordinary burners after a short time become clogged with soot. The latter defect can be overcome by the use of an injector burner, which, however, requires a higher pressure. Various diluents have been suggested, but have not been tried on a practical scale. The flame has a high actinic value, and causes light colours to appear lighter, and dark colours darker than when exposed to sunlight. The gas, when inhaled, combines with the hæmoglobin, and renders the blood incapable of taking up oxygen, and thus causes suffocation. It has, however, been shown that it is no more dangerous in this respect than coal gas. Acetylene united with copper, in presence of moisture and ammonia, forms copper acetylide; and this when in a dry state is violently explosive. Silver is similarly acted on.

Owing to the difficulty of obtaining the materials used in producing calcium carbide in a pure state, phosphoretted and sulphuretted hydrogen and ammonia are often found in the gas; and these should be removed by passing it through water and an acidified solution of a metallic salt. Nearly all proportions of air and acetylene are explosive; the gas itself being decomposed at 780° C. At higher pressures than two atmospheres, if this temperature is attained by a part of the gas, it is communicated throughout the whole mass, and a violent explosion occurs, which causes the pressure to rise to eleven times the initial pressure. But, owing to cooling by radiation, &c., this is not reached in practice.

Acetylene can be readily liquefied, having a critical temperature of 37° C. and a pressure of 68 atmospheres. The resulting liquid is very light, and has a high coefficient of expansion. Although this is a convenient method of storing a large quantity of gas in small bulk, it is unsafe, because of the ease and violence with which it explodes. The gas is extremely soluble in acetone; and it has been suggested that this property might be used for its storage. But it has been conclusively shown that acetylene does not, even when thus dissolved, lose all its explosive properties.

Numberless devices for generating acetylene have been invented; its application, however, is more dependent upon its cost than upon the apparatus used in its manufacture. With calcium carbide at £16 per ton, it can compete with coal gas at 2s. 6d. per 1000 cubic feet, when flat-flame burners are used for the latter, and a light of not less than 30 candles is required. This renders it peculiarly suited for buildings in which coal gas is not obtainable. It has been used for lighting a station on the Great Southern and Western Railway of Ireland, and at the Salford Docks of the Manchester Ship Canal. In the latter case, special portable generators are used, which can be carried to any part of the docks, and which may be placed on the quay side and the gas led away to lamps in the holds of vessels. Among many other uses suggested are the lighting of lighthouses, lightships, buoys, military signals, &c., and as a standard of light. Its price prevents its utilization for engine driving. This reason also prohibits its use as an enricher of coal gas, as it does not with low percentages give an increase of more than 1 candle power for 1 per cent. of acetylene. With "blue" water gas it is even less applicable, as above 10 per cent. is required before any illumination is obtained. Methane and nitrogen are claimed to carry the gas without affecting its illuminating power.

For the lighting of railway carriages, where the gas is under pressure in reservoirs, it is essential, to prevent too frequent re-charging, that it should have a high illuminating power. In addition to possessing this qualification, acetylene does not liquefy until it is at 21·5 atmospheres at 0° C., whereas oil gas loses valuable hydrocarbons, which are condensable at pressures below 9 atmospheres—the usual pressure to which oil gas for use in carriage reservoirs was at first subjected. The loss of these illuminating agents reduces the lighting power to about 40 candles. Acetylene meets with the same difficulty in the case of carriage lighting as in others—viz., that so powerful a light is not needed as would give the best illuminating value for the acetylene gas consumed. The author submitted tables to show that acetylene has a nominal illuminating power of 240 candles per 5 cubic feet per hour burnt, and oil gas has only 40-candle power, or as 6 : 1, yet for a consumption of 5 cubic feet per hour the highest value of acetylene is a little more than 200 candles, or 40 candles per cubic foot per hour, while oil gas gives 8 candles, and the ratio becomes 5 : 1. If this could be maintained, acetylene manufactured from calcium carbide at £16 per ton would be cheaper per unit of light than oil gas, though the cost would be 0·103d. per burner-hour for the latter against 0·396d. per burner-hour for acetylene. A light of 40 candles is not, however, required in a single compartment, which, in fact, would, even with the tendency to demand better lighting, be brilliantly lit with 20 candles. To obtain this lighting with acetylene, would require a consumption of 0·585 cubic foot, costing 0·231d. per burner-hour; while it could be obtained with oil gas burnt in a regenerative lamp consuming 1·464 cubic feet per hour for 0·1507d. per hour. Assuming that two reservoirs, each of 10 cubic feet capacity, were placed under a five-compartment carriage, and charged to 105 lbs. per square inch above atmospheric pressure, the reservoirs would require re-charging in 47·8 hours if acetylene were used, as against 19·2 hours with oil gas.

A discussion on the paper was opened, and adjourned till this (Tuesday) evening.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

Annual Meeting in Boston.

The Twenty-eighth Annual Meeting of this Association was held on the 16th and 17th ult., under the presidency of Mr. S. J. Fowler, of Springfield (Mass.). Mr. W. A. Stedman was elected an Honorary Member, with twelve new ordinary members.

In his Inaugural Address, the President referred to the loss of five members by death during the year, and congratulated the members on the steady increase of business in the district, which enabled gas to be reduced in price. Reduced prices, as applied to any commodity, increased the number of purposes for which it could be used. The enormous extension of the street-railroad system in their cities had the effect of enlarging the inhabited area, as even working men left the centre and moved to the outskirts to live; and this necessitated a corresponding extension of main-pipes. In his own district, the result had been an important decrease in the sales of gas per mile of main. But in other towns, he observed that the sales per mile of main and per consumer remained fairly stationary. He showed, by examples, that the sale per mile of main had an important effect on the actual selling price. He referred to the proposed New England Gas and Coke Company, who intended to make coke on the large scale from Dominion coal or slack, and supply the gas to existing undertakings at a cheaper rate than they could make it for themselves. He had had the pleasure of inspecting the plans for a plant designed to deal with 1200 tons of coal per day; and he believed that, as an example of engineering applied to the handling and utilization of coal, they were worthy of careful attention, as affording valuable suggestions for ordinary gas-works. In England, the cost of handling coal and coke had been greatly reduced by the introduction of machinery and new processes; but it seemed doubtful whether anything would come of the coke-oven pipe-line scheme. He was glad to notice a great improvement in the relations with their customers. The clerks and collectors were now fully alive to the necessity for courtesy, deference, and regard for the interests and feelings of consumers; and the honest efforts of the companies to extend every courtesy and facility were meeting with recognition, and they were credited with doing their best.

Mr. H. A. Allyn, of Cambridge (Mass.), read the first paper, on "Gasholder Construction." An important question, when a new holder was decided on, was "What size shall it be?" In deciding this, it was not only necessary to look at present needs, but also at probable future requirements. The author appeared to consider, according to some figures he quoted, that the storage capacity should equal, if not exceed, two days' maximum supply. Small holders might be housed; but for large ones the expense was prohibitory. The risks in connection with brick tanks were such that he preferred steel throughout. Some put in a brick

or concrete bottom, to lessen the expense; but he thought that the saving was not worth the risk. The unequal expansion and contraction of the two materials might sooner or later develop leakages that would prove troublesome and costly. If estimates were invited for a holder of a given capacity, with no other dimensions stated, the contractors would probably lay out a holder of small diameter and considerable height, as it was cheaper to increase the height than the area. But raising the height meant increasing the back-pressure, and so he preferred to make the area as large (within reasonable bounds) as circumstances would permit. As an example, he instanced a holder recently erected to his specification, 150 feet diameter, in three lifts of 30 feet each. The first lift gave 3·5 inches pressure; the second, 5·3; and the third, 6·5. He advised those about to prepare a specification for a holder to carefully study every example of about a similar size to that required of which they could obtain particulars, to consider every detail, and to improve on each if possible. Contractors who were asked to tender should be furnished with full details, so as to avoid returning tenders for revision or alteration; and the offers when received should be carefully compared together, in order to see who proposed to give the greatest value for the money. The nature of the soil on which the holder and tank were to be erected was important, as affecting the kind of foundation required. The site available for the holder he had mentioned was an old salt marsh covered with *débris* to a depth of about 4 feet. This being removed, he found about 3 feet of meadow peat, underneath which was a bed of natural sand about the same thickness, resting on blue clay of unknown depth. He decided to lay a concrete foundation on the sand. This was made of 2 parts portland cement (the best obtainable), 6 parts sand, and 12 parts broken stone. A belt of concrete, 2½ feet thick and 7½ feet wide, was first laid as a support for the sides of the tank; and this projected 4 feet beyond the circle covered by the same. The remainder of the area was covered by 18 inches of concrete. A low retaining wall was built round the tank at 2 feet distance from it, to allow of free access, to keep the earth away, and to serve as a support for steam heating-tubes. Altogether 1427 barrels of cement and 1500 tons of broken stone were used; and the sand was obtained from the excavation. In addition to the regular inlet and outlet, which were situated on opposite sides of the tank, he provided a third connection which could be used either as inlet or outlet, in the event of trouble from naphthalene. In concluding, he maintained that continual vigilance from beginning to end of construction was indispensable to secure a perfect holder.

The President having invited discussion, Mr. Harbison gave some details of a three-lift gasholder in a steel tank, which extended 10 feet below the ground level, and was supported for that distance by a brick wall 3 feet wide at the base tapering to 2 feet at the top, but without any space between it and the steel sides. Clean sand and good stone were necessary to make an efficient concrete. He thought gas managers should not dictate too much to contractors, who must necessarily have had wider experience than themselves in constructive details. The capacity of his holder was 600,000 cubic feet; and he did not believe in housing it. It was necessary to use vigilance, not only during construction, but in caring for the holder when put into use. At Hartford, he had to contend with a tidal variation below ground of about 27 feet; and from this cause all his brick tanks were more or less leaky, till they were provided with steel linings. There was about an inch space left between the lining and the tank, which was filled with cement; and his five tanks were now quite tight. He was therefore like the author in favour of steel tanks and the best possible workmanship; but he did not believe in a steel bottom. He could get good bricks in his neighbourhood; and his plan was to lay a course all over the bottom on the concrete, and to put a coat of cement mortar over it, neatly finished off with a smooth surface. Mr. W. A. Learned said he had recently constructed a 700,000 cubic feet gasholder in three-lifts; the diameter being 103 feet, and the total height 133 feet. He was able to get a good foundation at about 4 feet below ground level. On this he spread a layer of concrete composed of 1 part cement, 2 parts sand, and 3 parts broken stone, 20 inches thick at the centre and 24 inches at the sides. Common cement showed 90 lbs. tensile strength on a twenty-four hours' test, and 11 per cent. coarseness when passed through a 100-mesh sieve; while portland cement showed 226 lbs. per square inch, and 17 per cent. coarseness. He attached importance to these tests, and preferred coarse cement for neat work, and fine for mixing with sand. The sides were of steel, and the bottom of concrete only; and by inserting a horizontal plate at the lower edge of the tank sides, and embedding the whole in cement, a tight joint was secured. The author expressed fears of leakage from unequal expansion and contraction; but the fact was that the co-efficients for steel and for cement were approximately the same. A great deal of work was now being done with combined iron and cement—iron rods being embedded in the concrete. He knew of a 100 feet span arch which was so constructed. A steel bottom laid in the usual way would not strengthen the concrete. To do this, it should be underneath, and not above. Any settlement would carry the concrete down, and the steel bottom would probably follow. He also contended that it was impossible to exclude air from the underside of the plates, even with the most careful grouting, and that therefore a great risk of oxidation was incurred. He believed that many steel tanks would become leaky from this cause. The composite tank, with steel sides and cement bottom, was not only cheaper but superior to an all-steel tank; and it was therefore to be preferred. A brick wall, about 6 feet high, was built round the outside of the tank at the base. Mr. Prichard said he had built a tank that was substantially similar in design. He had a thickness of 4 feet of peat, under which was sand, in which the tide rose to a height of 10 feet above the bottom of the holder. Special precautions were taken so as to prevent the sea water from coming in contact with the steel sides of the tank; and it was surrounded by a carefully built brick-in-cement wall. Mr. Shelton preferred the all-steel to the composite pattern tank; and he also spoke highly of the stability of sand when so enclosed that it could not be washed away. Once in Florida he built a tank with a bottom of well-rammed sand only; and it was perfectly tight. Of course, it was not subject to any action but that of surface water; and this was kept away by the circular wall. In many cases, the cost of the concrete foundation was an important item; stone or sand might be scarce in some localities. Given good sand properly enclosed, and a course of brick laid over it to stand the wear during erection, they would have a tight bottom. But this plan was not to be recommended in all instances; and it would not do where there was tidal influence or outside water to be dealt with. Mr. Mayer, who claimed to be the originator of the composite tank system, said that something more was needed in comparing competing schemes than a mere reading of the specifications. It was not a question of obtaining the largest quantity of material for a given sum, but of securing the greatest strength or efficiency, which was rather a different thing. He not only believed in concrete bottoms, but in concrete sides also; and he thought that the present sheet-steel sides would be eventually displaced in favour of concrete, in combination with iron or steel ribs. This method of construction was invented by a Frenchman named Monier, and was taken up by German engineers, who had constructed bridges in cement with a network of steel rods embedded in such a position as to take the tension strains. He had seen an arch of 130 feet span, with a thickness of not more than 6 inches at the centre. It had been standing for many years, and remained perfectly sound. The same principle could be applied to gasholder tanks. A narrow tall holder was as strong as a flat wide one, and very much cheaper in first cost. Under ordinary circumstances, the total height might be about equal to the diameter; but local conditions often required some different proportions. The chief objection to the tall holder was the heavy pressure, and the great variation between the pressures given by the different lifts. Mr. Ramsdell remarked that, in comparing some figures lately, he had observed that the cost of a 300,000 cubic feet holder and tank in two lifts, was about the same as that of a 400,000 feet one in three lifts. Mr. Sherman said that the old formula of holder capacity equal to 24 hours' consumption was now excessive, thanks to increased day business and water gas. He found no difficulty or inconvenience in supplying nearly double his total holder capacity in 24 hours. He made half water and half coal gas, and not a fixed quantity of coal gas and a variable quantity of water gas according to demand. One-third of the total consumption was taken during daylight.

Mr. Allyn, in replying, said that the contractor might have more constructive experience than the gas manager; but, on the other hand, the manager would detect little defects in working, in the course of everyday experience, that would not come under the contractor's notice. The manager should have some brains, and know a little about his business and its requirements; but at the same time he could profit by getting specifications which embodied the experience of contractors.

(*To be continued.*)

THE CONSTRUCTION OF INCLINED GAS-RETORTS, CHARGING APPARATUS, AND CONVEYING MACHINERY.

By MAURICE GRAHAM, Assoc.M.Inst.C.E., M.Inst.M.E.

A Paper read before the Birmingham Association of Mechanical Engineers, March 8, 1898.

(*Concluded from p.* 592.)

Passing on to coal handling or conveying machinery, it will be necessary to turn your attention to the receiving hopper A, on Diagram I. (*ante*, p. 589), under the coal-waggon. The regulating door is balanced with weights, for ease in adjustment. The screen C should be made at an angle of 36°, and should have a jigging motion worked by an eccentric or cam; the object being to separate the fine coal, and preserve a steady delivery to the breaker. The mesh should be about 1½ inches; otherwise a large percentage of the fine coal goes through the breaker unnecessarily. The breaker D has four teethed rolls, made of chilled steel, which are capable of breaking cannel. They are diamond pointed, and crack the coal instead of tearing it. There is another advantage also, which is that if the breaker got choked, the rolls would still revolve, because they would cut a path of their own, without forcing the coal up and round the dead plate at the back. The teeth of the rolls work into one another at the distance required—say, about 2 inches space between. The adjustable coal-crusher is not required for inclined retorts, as one size of coal is sufficient—viz., the largest

pieces, about 2 inches cube. However, in coke-crushers on the same principle adjustable rolls are easily provided to suit the demand.

The regulation of the coal to the boot of the elevator has always been a source of trouble when delivered direct from the crusher, as it then depends entirely upon the attendant in charge. To overcome this drawback, and to obtain a regular supply for each bucket of the elevator, I have patented an automatic feeder which will guarantee not only steady delivery, but will register by measurement the amount of coal going through the elevating plant, providing the coal breaker is always well covered. The arrangement is a distinct improvement on the plunger feeder as used in stokers for boilers; the dead-weight and friction being reduced. The shoot underneath should be constructed to allow of ready access in cleaning out, &c., as I have seen considerable difficulties in this direction. The design of elevators is very varied indeed; but having studied them closely for working results, the latticed double-guide elevator for all classes of material has the preference. The guides are lined with wood, not only to reduce friction, but also to lessen the noise in working.

When any dusty material is dealt with, or the elevator is in the open air, the cased-in elevator is suitable; but provision must be made for ready access in case of need. Nothing is more unsightly than to see an elevator with its return chain swinging loosely with the buckets attached to the same; and yet I have noticed this even in gas-works. The lubrication of these elevators and conveyors is preferably done with plumbago; it makes a cleaner lubricant, and also prevents the accumulation of any gritty deposit upon the guides, and thus the increase of the wear and tear of the plant, which is about 5 per cent. The best angle for elevators to work at for delivery and feed is 60°. There are various forms of chains for elevators; but nothing can beat the detachable chain, which has no pins to get out of order, and which can be made of any strength required and fixed in the single or double strand elevator. The speed of the elevator averages about 90 feet per minute.

The connecting or delivery shoot from the elevator to the conveyors should not be less than an angle of 45°; otherwise the material will choke the shoot, and consequently affect the elevator, and very probably throw off the belt which drives the breaker. This belt-drive is the safety-valve against breakages. The direct drive from engine to breaker causes the vibration to affect the piston springs in the cylinder, owing to the sudden shocks, especially in cannel breakers. The coal-conveyors are usually built latticed over the coal-bunkers (see Diagram II.); but over the stages they are covered in and dust-proof. In this instance, the casing should be made so as to have ready access to the interior for cleaning-out purposes and lubricating, &c. When any stoppage or breakdown occurs, the conveyor must be emptied before starting. The conveyors should all be lined with wood guides. The speed of these conveyors is about 90 feet per minute, for steady work. The conveyor in all cases should be larger in capacity than the elevator, so as to receive the delivery of material and move it away quickly, and thus prevent any chance of choking.

In working out the horse power of elevators, the proportion of weight upon the guides should be taken into account. I here mention that the working of the conveyors is entirely automatic as regards distributing the coal into the large storage bunkers (see Diagram II.). There are a series of openings in the trough of the conveyor, so that when the coal has been deposited in the bunker and rises to the first opening, the scraper carries it forward to the next, and so on, until the end is reached, when the attendant stops feeding the breaker, and runs the plant empty for five or six minutes before stopping it. There is no machinery in motion during the night shift, wherever the continuous storage tank is adopted; and this alone will compensate an engineer for the adoption of it. The minimum of labour, therefore, for handling this large quantity of material is a great inducement to adopt the most automatic appliances possible; it requiring only one man to attend to the engine as well as feed the breaker.

To continue the automatic handling of coal, underneath the bunkers are fixed measuring chambers (see Diagram V.), which are of sufficient capacity to hold the largest amount of coal that can be charged into the retort. The detail of this chamber is shown. For altering the capacity available for the coal, a swing flap G, made of ¼-inch plate, and provided with an arm and quadrant, is introduced. By this means, the quantity required can be adjusted by ¼ cwt.

There is a slide A at the top, and a slide B at the bottom, connected by a main lever C working on a pivot, so that when the top is open the bottom is shut, and *vice versâ*. But when these chambers were first introduced, it was possible for the stoker to open the bottom slide only half stroke; and consequently the coal ran in from the top bunker as fast as it fell out of the chamber, and all ideas of measurement, for which the chambers were designed, were upset. Not only this, but the stoker could shut the slide at his own discretion, and put any quantity of coal into the retort he wished, either more or less. Many times insufficient coal was charged in, and the retorts would run for six hours without doing any work. Every available obstacle was placed in the way to prevent the system being a success, owing to the great amount of labour saved by its introduction, and also there being no skilled stokers required for the work.

The outcome was that I patented the simple arrangement known as Graham's patent "Sure Feed," No. 2937, of 1894, which is now universally adopted for guaranteeing the correct measurement of coal or other material. This simple appliance I connected on to the bottom of the measuring chamber; and it is shown in Diagrams I., II., III., IV., and V. The case is made of wrought iron. On the top of the box is a slide or slides D, for regulating the area of the opening required to suit the variety of coal being carbonized. Thus, when slack is used, the slide is opened slightly, and a greater velocity allowed; but when lively coal is employed, the slide is closed a little. The charging of the centre retort acts as the mean for the other two tiers. This slide, in the position shown, is of vital importance to the delivery of the coal inside the retort, especially where only one measuring chamber suffices for supplying the coal for three different heights of retorts (see Diagram II.). Inside the box a balance-plate works upon a pivot; and connected to the axle is a lever and balance-weight E. The main slide F of the chamber is shown at the bottom. When the chamber is full, the weight of the coal presses this swing balance-plate H upon the main slide F, and at the same time closes up the opening for the exit of any coal. When the main slide F is gradually opened, no coal whatever can fall from the measuring chamber until the balance-plate falls; and this cannot fall until the main slide F has completed a full stroke. By this time the top slide of the chamber A is full shut, and no more coal can pass. When the balance-flap has fallen, the stoker cannot shut the main slide F, because the weight of the falling coal keeps the flap down (see fig. 4). When, however, all the coal is out of the chamber, the flap rises; and the stoker then shuts the bottom slide, and allows the coal to enter again from the top (see fig. 3). By this means, the control of the weight of the charge required per retort is entirely out of the hands of the stoker; and a guaranteed measurement is obtained. This has been proved not to vary to two places of decimals between measurement and weight brought into the retort-house. The foreman stoker has control over the adjustable flap G for regulating the charge in the measuring chamber; and the stoker is merely required to insert the mouth of the shoot and pull the lever P, shown on Diagram I., and when the coal has fallen, to push the lever back again to its original position.

This continuous arrangement of coal-storage tanks, measuring chambers, and "sure feeds" completes the automatic storage and handling of coal required for this system. The whole of the labour required therefore to bring the quantity of (say) from 50 to 300 tons from the railway waggons to the charging end of the retort is one man. I wish to mention at this opportune moment, and before describing the charging shoots, that this arrangement (as shown in Diagram V.) can be advantageously adopted irrespective of the design of the shoot, and is equally advantageous for correct measurement of the coal whether the shoot contains the charge in suspension, as in Diagram IV., or whether the design of conducting shoot only is used, as in Diagram III.

Diagram IV. shows an arrangement similar to that adopted by Mr. Shoubridge, in respect that it contains the charge of coal at rest. It differs slightly in not having the three shoots combined in one apparatus; and there is an advantage in having them single, because when one tier of retorts is being charged there is no necessity for the stoker to push along the other two shoots as well. Mr. Shoubridge's shoot was designed to be moved to an adjacent hopper and receive its three charges of coal, and then be run along with the full weight to the retort to be charged. This labour can be done away with by the introduction of overhead measuring chambers; and the charge can also be accurately measured, as described, before dropping into the shoot.

Diagram III. shows the tubular shoot which has been universally worked since the commencement of inclined retorts, though improvements have been added for checking the velocity of the falling coal and obtaining an even delivery within the retort of any variety. The tube is made of light steel sheet, and is hung upon a carriage and frame. At the lower part of the shoot, two baffle-plates are introduced; and these are connected together by levers, connecting-rods, and quadrants on the outside. By this means, the area of the opening can be adjusted according to the distance of the fall of coal from the chamber; and it will be noticed that fig. 1 shows the baffle-plates more open than in fig. 2, and the latter more open than in fig. 3. These plates are moved in conjunction with slides on the top of the "sure feed," and only require regulation when the class of coal is altered. Two or three minutes between the charges suffices to move these bafflers; and the stoker can move, and adjust them to a nicety. The lightness in weight of these thin shoots (which are about ⅛ inch thick) makes it very light work for the stoker to move them along.

By the omission of a word from the MS., the meaning of the latter portion of the first paragraph of Mr. Graham's paper, given last week, was reversed. What the author meant to say was that out of the 12¼ million tons of coal used in the gas industry per annum, "*not* more than 25 per cent. is dealt with mechanically;" and he adduced this fact as a justification for bringing the subject of his paper before an Association of Mechanical Engineers. It may also be pointed out that in Formula No. 2 (p. 592) there should have been a θ after "cos." This character was accidentally broken off in the printing.

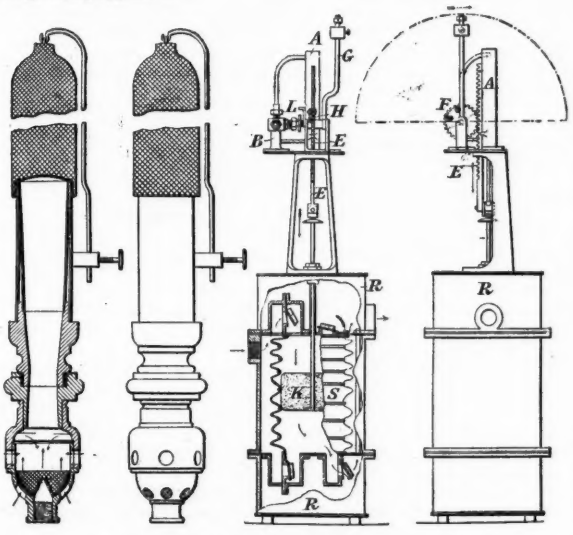
REGISTER OF PATENTS.

Lighting and Heating by Means of Gas, &c.—De Schodt, P. G., of Brussels. No. 1252; Jan. 16, 1897.

This is the invention referred to in the "JOURNAL" for Nov. 9 last; and there seems to have been a strange delay in getting the Patent Office formalities complied with. A complete specification was lodged with the application on the above-named date; but it was not till after no less than thirteen months—that is, on Feb. 16 of the present year—that the specification was accepted.

In the course of his general observations on the invention as applied to lighting and heating by means of gas, the patentee remarks that the problem of obtaining high temperatures in this way is solved in the case of the blow-pipe by: (1) Bringing together five volumes of air and one volume of gas; (2) intimately mixing the air and gas; (3) imparting to the mixture a certain momentum which is preserved until the mixture arrives at the point of combustion. The invention has for its starting point the observation made of the large amount of force lost in the blow-pipe in bringing together and mixing the air and gas, "which force may be almost entirely saved if care be taken to effect the intimate mixing beforehand." He has also observed that the momentum which the mixture must possess at the moment of combustion may be imparted to it by placing the air or gas under pressure. Moreover, he has noticed that it is not necessary, with a special construction of apparatus, to give to the gas a great increase of pressure for obtaining the suction of the air necessary for their mixture. A flame giving a high temperature can be produced by merely increasing the pressure in the pipes to a head of water of from 100 to 150 millimetres, or in some cases by utilizing the ordinary gas pressure while facilitating the introduction of air for forming the combustible mixture.

The flames thus obtained are used for heating mantles for lighting purposes, and large refractory surfaces for heating. Generally speaking, the apparatus for carrying the system into effect comprises: (1) The compressing apparatus, or device for producing the necessary pressure; (2) the suction and mixing device; (3) the burner. The compressing apparatus is designed "to ensure in the suction and mixing device the bringing together of the constituent elements in the desired proportions, at a pressure which permits of their intimate mixture, and allows them when mixed to pass to the burner with the force necessary for perfect combustion." Thus the compression, the suction and mixing device, and the burner together make up a combination which forms the gas-compressing apparatus.



As shown, the apparatus is composed of a cylinder A held at some distance from a reservoir R, in which the compressing apparatus or bellows S operates; the latter being in communication alternately with the inlet and the outlet of the gas through valves. In the cylinder moves a piston, the two faces of which are alternately acted upon by the water or steam coming from a distributing-cock B through suitable pipes. The movement of the piston is communicated, on the one hand, to a rack E, for regulating the movement, and, on the other hand, to the compressor. The rack gears with a pinion F, loose upon its shaft, and having two projecting stops. Upon the shaft is mounted a lever H, a weighted rod G, and a lever L provided with a projecting finger at its outer extremity. As the pinion F is caused to rotate in either direction by the rack E, one or other of the stops is brought into contact with the lever H, whereby the lever, together with the lever L and the weighted rod G, is raised to a vertical position. Upon passing beyond such position, the weighted rod G falls, imparting its downward motion to the lever L, the projecting finger of which actuates the operating lever of the four-way cock B in one or other direction alternately, and thereby reverses the stroke of the piston in the cylinder A.

The lower end of the central rod is fixed to the wooden block K, which is rigidly attached to the bellows S. The two parts of the bellows act separately, and alternately as a suction device and as a compressor.

The suction and mixing device, when supplied with gas under pressure, fulfils a double object—with a minimum of force it must inject the quantity of air necessary for the complete combustion (five volumes of air for one volume of gas); and it must effect the intimate mixing of the air and gas. The first condition for operating with the minimum of pressure is to avoid as far as possible any loss of force due to the employment or construction of the injector. A single injector, of conical form, is therefore employed as shown. After leaving the injector at a higher pressure, the gas passes into a mixing chamber, where it produces a partial vacuum, which will, of course, vary according to the volume and the velocity of the gas by which it is produced. The mixing chamber is surmounted by a convergent divergent cone, which performs the function of accelerating the velocity of the mixture, and also of facilitating the admission of the air necessary for perfect combustion. In mixing the air and gas, it is necessary to produce eddies or whirls, so as to cause a thorough and intimate mixture; and this is attained in the form of burner shown. Around the inlet-nozzle, which (as above stated) has an aperture sufficiently wide to minimize loss of pressure, are provided air-inlets, the axes of which are parallel to the surface of the cone, so as to obtain a maximum draught. The cone terminates in a widened chamber, above which is arranged a divergent convergent cone designed to exert upon the mixture an upward suction capable of compensating for the loss of pressure caused by the eddies or whirls.

As to the burner, the patentee remarks: The combustion of mixtures which are very rich in air give rise to very hot and very short flames. If the combustible mixture producing these flames were moving with a very slight momentum, it is evident that the heat of the flame would be communicated to the wire gauze which covers the burner, and thence to the injector. If, however, the momentum be sufficiently increased, the point at which combustion takes place will be carried some little distance above the wire gauze—thus forming a zone in which combustion does not take place, and which acts as a protecting screen for the wire gauze. But it is necessary, in order to ensure this result, that the injector shall not receive any heat from the burner. For this purpose, the burner is provided at its lower part with a non-conducting ring, and is composed of a divergent cone, at the top of which is provided a wire gauze cover. It must be constructed so as to be as little as possible in contact with the mantle to be heated to incandescence. For this purpose, it is provided with a washer composed of asbestos or other non-conducting material.

Below a certain limit the pressure of the gas supplied directly from the pipes is, says the patentee, too feeble to obtain the desired result without the assistance of some form of compressing apparatus. Where additional pressure is required, however, it is not always possible to impart the necessary momentum to the gas by any of the means already indicated. For instance, in the case of public lighting the use of a motor for producing the required pressure would not be convenient. Without departing from the nature of his invention, however, he has sought a means of dispensing with a motor for these special cases. In such cases where it is necessary, he utilizes the properties of hot air for conducting the desired volume of air to the suction and mixing device. It is well known that, if a vertical tube communicating at its two ends with the atmosphere be heated, an upward current is produced the intensity of which depends on the height of the tube and the degree of heat applied. He utilizes this principle for public lighting, by heating in the lower part of a street-lamp a pipe terminating in the suction and mixing device, so as to conduct into the latter a quantity of hot air under a certain upward pressure, which will facilitate the suction caused by the injector, and give the proportion of air required.

Manufacture of Acetylene.—Strode, W. W., and White, G. H., of Osnaburgh Street, N.W. No. 6658; March 13, 1897.

The principal feature of this invention is the provision of means not only to enable the supply of water to the calcium carbide to be automatically regulated in proportion to the consumption of gas, but to enable the supply to be automatically increased during the process of exhaustion of gas from the holder, so as to neutralize any absorption of water by the slaked slime formed in the retort. The holder itself may serve to displace the water from the vessel in which it works (which is preferably made in the form of a jacketed cylinder); the thickness of the sides of the holder being such that the amount of water displaced as the gas leaves the holder, by reason of the holder falling, bears any desired ratio to the volume of gas withdrawn. The sides of the holder are tapered, or thickened towards the top, so that if the displacement of water by the working of the holder when fully charged with gas is not sufficient to generate enough gas to equal the demand, a greater proportion of water can be supplied to the retort.

Gas or Liquid Fuel Engines.—Reeve, S. A., of Worcester (Mass.), U.S.A. No. 7098; March 18, 1897.

This invention relates to engines in which a mixture of air and fuel is continuously burned in a combustion chamber connected with the working cylinders of the engine. It consists in improvements having for their general objects, first, the automatic and uniform reduction of the fixed gases resulting from the combustion to a predetermined working temperature before they enter the working cylinders of the engine; and, secondly, the control of the proportion of fuel and air admitted to the combustion chamber, so that the relative quantities of fuel and air shall not materially vary.

Water-Meters.—Guilbaud, A., of St. Nazaire, France. No. 7294; March 20, 1897.

This invention refers to a water-meter for the use of small householders, so as to indicate the consumption of water by means of the usual dials. The third of these dials, however, is distinguished by a cylinder with interior screw, fixed upon an axle and receiving movement under the pressure of the water coming from the water-pipe. This movement it communicates by means of toothed wheels, which, through the intermediary of calculated multiplication gearings, move the hands on the other dials. A small tube thereafter leads the water accumulated in the envelope of the meter to the outlet-pipe of the meter.

Acetylene Generator.—Kitchen, J. G. A., of Manchester. No. 7918; March 27, 1897.

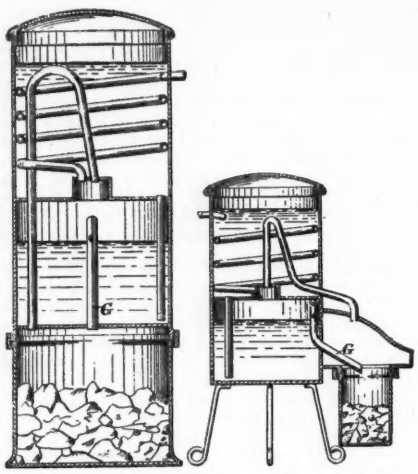
This invention relates more particularly to portable generators for use in connection with table, vehicle, and hand lamps, and with small-power internal combustion motors, such as are used for propelling wheeled vehicles and boats. The generator consists of a gas-tight vessel to contain water, having a hollow base, a flexible collapsed chamber in the base communicating with the vessel, a perforated basket for containing the carbide loosely fitted into the vessel, a shield for preventing the water from coming into contact with the carbide in the event of the apparatus

being upset, and a gas outlet-orifice closed by a tap. The pressure of gas produced forces the water out of contact with the carbide into the india-rubber chamber (which is collapsed in its normal state), and so prevents any further generation of gas.

Acetylene Generator.—Smith, F. H., of Dunblane, N.B. No. 7929; March 27, 1897.

This acetylene generator is so designed as to enable the supply of water to the carbide to be stopped without the use of a valve.

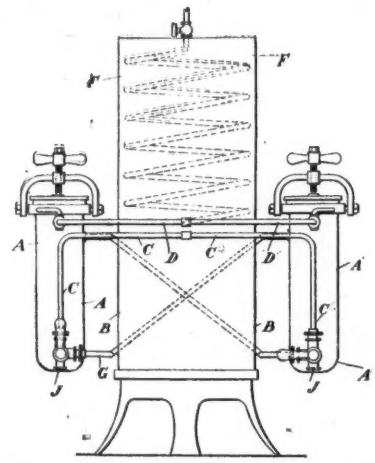
There is an upright cylinder or tank, the lower part of which is for the generation of the gas, and the upper for the water. The upper part of the cylinder is divided into two chambers; the water poured into the top one escaping into the lower part by a pipe which extends to near the bottom. To the bottom of this chamber, and leading to the carbide chamber, is fixed an upright pipe G, having a slot formed in the side at



the upper part. When the water rises to the height of this slot, it passes into the carbide chamber below. The generated gas escapes to the top of the water chamber, from which it is led by a coiled pipe to the holder or burner. As soon as the gas attains a certain pressure, it (acting on the surface of the water) forces the water out of the lower chamber into the upper one, until the level is brought below the slot of the tube G, when the supply being thus stopped any fresh generation of gas is also stopped until the pressure of the gas in the lower chamber is reduced so as to allow the water to flow again from the upper into the lower chamber, when the water reaches the slot, and the gas generation is again renewed.

Manufacturing Acetylene.—Exley, J. H., of Huddersfield. No. 8551; April 3, 1897.

This invention relates particularly to that class of apparatus for manufacturing acetylene in which two or more generators are used—the second generator to be automatically brought into operation when the first is exhausted.



The generators A are mounted each side of the holder B; and the water-passages C connect them to the holder. The gas-passages D are both connected to a cooling-coil in the water-cistern F. Taps are provided in the gas-passage. Pipes are furnished to connect the upper part of each of the generators with the lower part of the other. Consequently, when one generator is exhausted, and the passage between it and the other generator is open, the water from the first generator flows down this passage into the second generator, and the production of gas is continued. Four-way cocks are fitted to control the passages, as well as the waste-outlets J.

To prevent the full charge of the generators being acted upon at once—that is, to enable comparatively small quantities of calcium carbide to be acted upon—a number of small generators may be coupled together by passages connecting the upper end of the first generator to the bottom of the second generator, and the top of the second generator to the bottom of the third, and so on. By this means, when the first generator is exhausted, the water flows from it into the second; and so on, through the series.

Coin-Freed Apparatus for Water Supply-Pipes.—Jonker, L., of Amsterdam. No. 16,758; July 15, 1897.

This apparatus—whereby, on the insertion of a coin, a certain quantity of water can be obtained—is intended to be connected to a water-meter of any suitable construction, so that the amount of water drawn off can be read upon the counting dial of the meter itself. The characteristic feature of the appliance is a tap connected to the supply-pipe and opened by means of a lever, a sliding-piece, and a handle. As soon as a coin is introduced into the slot provided for the purpose, the sliding-piece is caught by a bolt, which, after the delivery of the water, is depressed by the action of the wheel-work of the counting mechanism of the meter, so as to release it and allow the lever to be pulled back, in order to close the tap, by the action of a weight or spring.

Gas-Engines.—Thompson, W. P.; a communication from the Chevalier H. Parthon de Von, of Uccle, Belgium. No. 23,361; Oct. 11, 1897.

The patentee proposes the application of a governor ball-regulator, to adjust a sloping plane horizontally according to the number of revolutions of the motor. The apparatus is interposed between the free end of the inlet-valve spindle and an eccentric rod operated from the motor shaft. In combination with the arrangement, is an inlet-valve placed underneath the mixing space, which is so arranged (with the air passing into an annular channel around the valve-seat) that at each lift of the valve the air passes into the annular space, into which (through a channel) the gas enters, so that at each lift of the valve the mixture of air and gas, and its flow into the space, takes place.

Self-Igniting Gas-Burners.—Duisberg, M., of Berlin. No. 25,584; Nov. 4, 1897.

This is a "platina sponge" type of gas-burner igniter—the ignition taking place in consequence of the peculiar construction of the cock employed in its four "exactly fixed phases of position." There is also an arresting-device, which always holds the plug exactly in its position conditioned by the phase of the igniting passage, "so that lighting cannot possibly be missed." The cock is bored as usual, and provided with a bye-pass bore for the ignition-flame; the plug being bored eccentrically, and in exact accordance with the cock. The plug is further provided with a disc with grooves and notches at its circumference; and into these grooves engages a trailing-spring, provided with a nose, which, with its plate and a piece bent upwards, holds this disc in certain positions. The bent-up piece, together with the notch at the rim of the disc, further forms a stop to the turning of the plug.

APPLICATIONS FOR LETTERS PATENT.

5508.—Richmond, E. W. T., "Gas fires or stoves." March 7.
5527.—Hooker, W., and Morrell, R., "Incandescent gas-burners." March 7.
5538.—Dedecker, L. J., "Production of acetylene gas." March 7.
5551.—Burkitt, E. D., "Gas-pendants." March 7.
5563.—Böhndel, H. H., and Tucholka, A. von, "Self-igniters for gas-burners." March 7.
5564.—Birch, G., Reilly, W., and Cowman, J. T., "Incandescent lamps or burners." March 7.
5578.—Dinsmore, G. F., "Manufacturing gas." March 7.
5583.—Wise, W. L., "Water-meters." A communication from The "Kölner Wassermesserwerke" Gesellschaft mit beschränkter Haftung. March 7.
5585.—Clark, A. M., "Incandescent mantles." A communication from Süddeutsche Glühkörper Fabrik F. Sauer. March 7.
5594.—Schlüter, C. H. P., and Lüdemann, C. L. F., "Generating acetylene." March 7.
5595.—Sheldrake, J. H., "Lanterns for streets and other exposed situations." March 7.
5649.—Harland, F. W., "Incandescent lamps and burners." March 8.
5667.—Cantley, H. J., and Davies, J. R. & G., "Incandescent light." March 8.
5701.—Clayton, R., and Steward, H. B., "Manufacture of acetylene." March 8.
5720.—Allsop, R. O., "Gas and other engines." March 8.
5729.—Miles, R. A., "Electric ignition of internal combustion engines." March 9.
5734.—Silver, M. J., "Handling incandescent mantles." March 9.
5760.—Main, J., "Generation of acetylene gas." March 9.
5784.—Symons, P., "Gas-lamp chimneys." March 9.
5808.—Hurst, J. A., and Harcourt, A., "Internal combustion engines." March 9.
5811.—Thompson, W. P., "Incandescent gas burners or lamps." A communication from A. Weber and Co. March 9.
5840.—Rowbotham, W., "Generating acetylene gas." March 10.
5853.—Bickerton, H. N., and Wood, W., "Gas-engines." March 10.
5855.—Bickerton, H. N., and Bradley, H. W., "Gas-engines." March 10.
5868.—Layton, A. E., "Padlocks for automatic gas-meters." March 10.
5876.—Peek, W., "Internal combustion motors." March 10.
5887.—Bellamy, A. R., "Gas-engines." March 10.
5908.—Vezin, R., and Oudry, A., "Manufacturing acetylene gas." March 10.
5922.—Witham, W. H., "Oil and gas lamps." March 10.
5941.—Smith, F. H., "Production of illuminating gas." March 10.
5945.—Grundy, F. B., "Burners for incandescent gas lights." March 10.
5956.—Hutchinson, A. & F. A., "Acetylene gas generator." March 11.
5973.—Thompson, G. F., "Generators for acetylene gas." March 11.
6006.—Percival, J., "Generators for acetylene and like gases." March 11.
6037.—Schou, H. H., "Valves for regulating the flow of gases or liquids." March 11.
6047.—Dupont, G., "Carburetting apparatus." March 11.
6054.—Green, W. O., "Coin-freed gas-meters." March 11.
6097.—Paterson, R., "Manufacture of acetylene gas." March 12.
6122.—Chesneau, A. F., "Acetylene lamps or generators." March 12.
6154.—Crop, C., "Improvements relating to incandescent gas and oil illumination." March 12.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

Instruction for Emergencies, and the Work of the St. John Ambulance Association.

SIR,—In the interesting and instructive paper on "Emergencies" read by Mr. Henry Townsend, of Wakefield, at the annual meeting of the Manchester District Institution of Gas Managers, the accident, which is not infrequent, of gassing is alluded to; and this leads me, as Organizing Commissioner of the St. John Ambulance Association, to draw the attention of all in authority in gas-works to the necessity of organizing "first aid" classes for their men, under the rules of our Association, on the same lines as obtains on railways, in mines, and with many other industries of the country.

To show the value of our work, let me draw attention to a recent terrible accident, and the good work done on this sad occasion by St. John Ambulance men. At the fire and explosion at Walkergate, near Newcastle-on-Tyne, on Jan. 29, there were upwards of 100 injured. The accident occurred close to the North-Eastern Railway, where the men of the Company had received instruction in "first aid," and what to do in emergencies from accident. As a result, when the terrible explosion occurred, and the injured were falling all round about, the ambulance men knew what was to be done, and, what was better, proceeded to do it promptly and without flurry. There is no doubt that this prompt action did much to lessen the suffering of the injured; and in one instance, where a leg and an arm were much shattered by a railway waggon going over the parts, life was saved by stopping the bleeding. As the "Newcastle Chronicle" said, "it was one of the most noteworthy examples that has occurred in this neighbourhood of the advantage of ambulance instruction."

With regard to the accident of gassing mentioned by Mr. Townsend, which is not uncommon in mines and iron-works, as well as in gas-works and other industries, I feel sure—and I write from much personal experience in years gone by—that our "first aid" work may be the means of saving many lives.

I hope, therefore, that gas managers may see their way to institute classes in "first aid" under the St. John Ambulance Association, so that there may be always ready help in emergencies in the various gas-works of the country in case of accident.

GEORGE A. HUTTON, Surgeon-Major,
Organizing Commissioner, St. John Ambulance Association.

Leamington, March 16, 1898.

P.S.—Full particulars of the instruction and work of the Association can be had from the Chief Secretary, St. John's Gate, Clerkenwell, E.C.

O'Connor's "Gas Engineer's Pocket-Book."

SIR,—In reply to "Youngster's" letter in your issue of the 8th inst., the two statements on pp. 145 and 232 are intended to show that, although coke, when stored in the open, will on the average decrease in weight, it will also after a heavy rainfall absorb as much as 20 per cent. of moisture. If this is not clear to "Youngster," I fear there will be many statements in my book which he will misunderstand.

In the compilation of a work of this sort, of 411 closely-printed pages, it is next to impossible to prevent some errors; and recognizing this, I state in my Preface that I shall be much obliged for the information of any incorrectness. Certainly the equations on p. 265 are, to our modern ideas, incorrect. But they were copied from a description of Hills process given at the time it was first suggested; and it was thought best to leave them in their original notation. As regards the quantity of lime required for purification, these statements should certainly have been brought together; and they should have had qualifying words added, expressing the fact that, while 40 lbs. would purify the gas from one ton of coal in a large works, it would require 70 lbs. in a small works.

To save "Youngster" the trouble of writing to you to indicate some other slips, I would take this opportunity of pointing out that on p. 255, on line 14 from the bottom, the word "main" should have been inserted after "condenser." On p. 323, 40 cubic feet of coal gas are said to equal 1 lb. approximately. This should be 24 cubic feet. Exception has been taken in another quarter to the placing of the specific gravities of gases and solids in one column on pp. 322 and 323. I thought every student knew that air was taken as 1 in the case of gases, and water in the case of solids; and that those who would use the book would understand this. The work was not intended as an instructor for "youngsters" but for experienced men.

HENRY O'CONNOR.

Edinburgh, March 12, 1898.

The Scottish Shale Oil Industry.

SIR,—I beg to thank you for the very favourable notice of my little book "Mineral Oils and their By-Products," which appeared in your issue of the 8th inst.; and I will endeavour to answer, indirectly, the questions you put to me.

A capital investment of £250,000 in the shale oil industry could undoubtedly be made to return 5 per cent. per annum, provided the money was spent in the right place. For instance, it would be of no use to try and conduct an independent business on such a capital; but if the shareholders of all the various companies could be prevailed upon to sanction an amalgamation of the whole of the companies, the £250,000 could then be put to very good use, and undoubtedly be made to yield even more than 5 per cent. Taking it for granted that the amalgamation was an accomplished point, and that the board of directors of the reconstructed company was composed entirely of practical men, the next point would be to obtain a site as central as possible to the various shale-bearing districts, and there erect a refinery capable of dealing with the whole of the crude oil production. Such a refinery need not cover nearly as much ground as some of those now in existence, provided that the antiquated and expensive methods and apparatus for dealing with the oil at present in vogue be entirely done away with, and business-like, up-to-date methods and apparatus be substituted for them. As soon as the refinery was completed, all others would, of course, be immediately "shut down;" and it would receive its supply from the various "retort departments" (located immediately in the shale districts) in tank-cars, as it is obviously very much cheaper to transport, say, 25 gallons of crude oil than one ton of shale; and therefore it is equally obvious that the retorts should be situated within reasonable distance of the pit-head, so that the expense now incurred by some firms in hauling hundreds of tons of shale a day a number of miles, may be done away with.

As I stated in my book, the retorting department has been well advanced, and brought about as near to perfection as is possible. But the refining department, on the other hand, has been sadly neglected; and at the present time apparatus that was in use in the sixties can still be seen wasting time and labour that might well be saved by the introduction of modernized and larger apparatus. Those companies who have made a business of producing crude oil *only*, have undoubtedly paid handsomely; and there is no reason why refining should not yield very nearly as large profits, if the manufacture is properly conducted.

Your question as to what price the products could be profitably retailed at cannot be readily answered, because I have not been in a position to follow up accurately the cost of raw materials in the last eleven years (ten of which were spent in America). But from the experience I had in Scotland prior to then—and I am advised by good authority that the methods, &c., have not greatly changed since—I see no difficulty in the way of reducing the coats sufficiently to make even the refining business a lucrative one.

There is undoubtedly sufficient shale existing in Scotland, that can be profitably worked, to last forty years or more at the present rate of consumption; and it is distressing to see this supply being gradually used up by some of the companies that only manage to eke out a mere existence from one year's end to another, when they ought to be in a healthy, dividend-paying condition.

ILTYD I. REDWOOD.

Belvedere, Kent, March 14, 1898.

Incandescent Gas Lighting at Windsor Castle.—The Denayrouze Light Syndicate have just fixed two of their three-light clusters at the entrance gates to Windsor Castle. The light is most brilliant, and is greatly admired.

Water-Works Improvements at Southampton.—In consequence of a report by the Water Engineer of Southampton (Mr. W. Matthews), the Water-Works Committee have recommended the Town Council to make application to the Local Government Board for sanction to borrow the following amounts: For a 24-inch gravitation main, £19,700; renewal of mains, £9000; eastern trunk main to Northam and Docks, £2300; two additional lime kilns, £300; and further headings at Otterbourne, £900—a total of £32,000. The recommendation was adopted.

The Larne Town Commissioners and the Gas-Works.—A special meeting of the Larne Town Commissioners was held yesterday week to consider the recommendation of a Sub-Committee that £4350 be offered to the Larne Gas Company for their property. A resolution that the recommendation be adopted was moved by Mr. Picken, who said the lighting of the town by electricity was becoming more and more expensive every year. By acquiring the gas-works, they could light the streets by gas, lower the price to the private consumers, and in time reduce the rates. In his opinion, if carried out, the purchase of the concern would prove to be one of the best steps ever taken on behalf of the town. Mr. Foster seconded the motion, which was carried.

The Price of Gas for Ordinary and Prepayment Supplies at Rawmarsh.—A long and lively discussion took place at the meeting of the Rawmarsh District Council last Wednesday on a recommendation of the Gas Committee that the price of gas be reduced 2d. per 1000 cubic feet. Mr. Bamforth moved an amendment that the question should stand over until the Council had before them the yearly report prepared by the Accountants. There had already been a reduction of 3d. to the large consumers who used above 2 million cubic feet a year. He also opposed the reduction because of the irregular way of dealing with the prepayment consumers, who paid 10 per cent. more for gas than others did. He knew it might be argued that the slot meters had been put in at great cost. But the consumers prepaid for the gas; and the collector had only to go round and bring in the money. In the case of the other meters, they might lose perhaps 2½ per cent. of the money due to them. There was, therefore, a difference of about 12½ per cent. between those who paid through coin meters and those on the ordinary system. He contended that the prepayment consumers were entitled to a proportionate reduction in the price of gas. Mr. Cook seconded the amendment. Several members took part in the discussion, in the course of which it transpired that the present charges were: Large consumers, 2s. 6d.; ordinary, 3s.; and prepayment, 3s. 4d. The voting resulted in a tie of six on each side; and the Chairman gave his casting vote in favour of the reduction.

Conditions Affecting Combustion in Gas-Flames.—The session of the First U.P. Church Literary Society of Selkirk was brought to a close on the 28th ult. with a very interesting lecture on the above subject by Mr. W. B. M'Lusky, the Manager of the gas-works in the town. The principal part was devoted to burners; the union-jet—the one most generally used in Scotland—being chiefly dealt with. The lecturer brought home to his audience the importance of having good burners by telling them that many of the burners in everyday use were responsible for a loss of light equal in money value to 1s. 5d. per 1000 cubic feet of gas consumed. He described the composition of coal gas, and demonstrated the most effective conditions of its combustion by means of a set of burners fitted up on the platform. He stated that, supposing the total time during which gas was required for domestic lighting purposes in one year amounted to 1400 hours, and that an unsuitable burner was used, the quantity of gas consumed would reach 7000 cubic feet, costing at Selkirk £1 4s. 9d. Should a type of burner giving the full lighting value be used, the total consumption for an equal light would be 4300 cubic feet, costing 14s. 10d.—a saving per burner per annum of 9s. 11d., or 40 per cent. Mr. M'Lusky dealt with the questions of pressure, the effective use of globes, the economy of gas-lamps and incandescent burners, and gas applied to the combined lighting and ventilating of halls or large rooms. In concluding, he emphasized the fact that good burners contribute to a pure atmosphere, and said the conditions of the occupants of private dwellings, and still more of workpeople employed in factories and other large establishments, were rendered more comfortable and healthy than they could be where defective burners were in use. At the close of the lecture Mr. M'Lusky was awarded a cordial vote of thanks.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:
Bill read a second time: Filey Water and Gas Bill.
Bill reported, with amendments: Aberystwith Gas Bill.
Bill reported, preamble not proved: Yeovil Gas Bill.
The opposition to the Liskeard Corporation (Water) Bill has been withdrawn.

HOUSE OF COMMONS.

Tuesday, March 15.

SOUTHWARK AND VAUXHALL WATER BILL.

Sir F. Dixon-Hartland moved, in accordance with the intimation given in the debate on the second reading of the above-named Bill on the 8th inst. (*ante*, p. 597)—"That it be an instruction to the Committee to provide that the point of measurement be at Penton Hook Weir, as provided by the Staines Reservoirs Act, 1896, and that the minimum flow to be left at that weir be at the rate of 300 million gallons per diem." This, he said, was the proposition of the Thames Conservancy Board in the interest of the Thames navigation; and the principle of the motion had been already twice affirmed by Parliament. It was right that the Water Companies should be treated fairly on the same terms; but the Southwark and Vauxhall Company were seeking an advantage over other Companies. Year after year this Company had set the Conservators and the House of Commons at defiance, by taking from the river more water than they had paid for—in fact, stealing the water, and selling it to their consumers. At last the Conservators, on the advice of a Government Department, sought and obtained an injunction of a Court of Law against the Company; and now the Company were before Parliament with a Bill asking for powers which were inconsistent with their own pledges, and which would give them an advantage over other Companies. This was not to meet an emergency or prevent a water famine, but simply for storage purposes; and the Thames Conservancy Board had come to the conclusion that the public interest required a minimum flow of 300 million gallons at Penton Hook, so that the river should not be denuded of water in the dry season.

Mr. Stuart Wortley asked the House not to accept this motion. He said he regretted that his hon. friend had used expressions and advanced assertions not directly connected with the main issue, and calculated to import prejudice into a subject requiring careful consideration on the facts. There was hardly a statement of his hon. friend that he was not prepared to dispute; and even assuming those statements were relevant to the issue, the House should not, and could not, decide between assertions on one side and denials on the other. A Committee duly qualified to sift evidence must decide such questions.

Mr. Chaplin said the Bill asked for further powers to supply the needs of the Company's consumers; and the principle upon which the Local Government Board had always acted had been that they could not give their sanction to any measure which was likely to prejudice or interfere with the supply of those needs. But another principle which the House ought to bear in mind was that, when a number of arguments were introduced by either side which were mutually destructive, they were not in a position to decide the matter, but should allow it to go before a Committee. This had always been the practice in matters of the kind. He therefore appealed to his hon. friend to withdraw the instruction.

Mr. Buxton, while approving of the views put forward by the mover, opposed the instruction on the ground of its mandatory character.

Sir F. Dixon-Hartland said he would withdraw the instruction, and leave the subject with perfect confidence to the Committee to be appointed. He had brought the question forward as a matter of public duty, and not from any private feeling whatever.

The instruction was then withdrawn.

The following further progress has been made with Bills:—
Bill read a second time and committed: Cromer Gas Bill.
Bills reported: North Warwickshire Water Bill, Northam Urban District Water Bill, Norwich Water Bill, Whitwick and Coalville Gas Bill.
The House resolved on Monday last week to concur with the Lords in their resolution (*ante*, p. 597) respecting generating stations for the supply of electricity.

HOUSE OF LORDS COMMITTEE.

(*Before the Earl of* Lauderdale, *Chairman, the Duke of* Bedford, *the Earl of* Dartrey, *Viscount* Bangor, *and Lord* Seaton.)

The above-named Committee—to whom had been referred the Aberystwith Gas Bill, the Redhill and Reigate Gas Bill, the Yeovil Corporation Bill, the Yeovil Gas Bill, and the Swansea Gas Bill—commenced their sittings last Wednesday.

ABERYSTWITH GAS BILL.

This Bill was promoted by the Aberystwyth Gas Company to acquire land for the purpose of erecting new works and to raise additional capital, with the object of laying down new plant. The removal of the works was required by the Aberystwith Town Council owing to the congested character of the neighbourhood in which they are situated. The Corporation approved of the broad principles of the Bill, but contended that the arbitration proposed by the Company—under the Lands Clauses Act—should be under the Arbitration Act.

The Counsel for the promoters were Mr. Balfour Browne, Q.C., and Mr. Fitzgerald, Q.C. Mr. Moreton Smith represented the Aberystwith Town Council.

The contention of the Company was that, having been compelled by the Corporation to remove their works, they would be put to large additional expense, and that the expenses consequent upon the removal should be borne by the Corporation under the provisions of the Lands Clauses Act, while the standard rate to be paid for the gas should be 5s. per 1000 cubic feet. Hitherto the Company had had power to charge as much as 6s. 8d. per 1000 cubic feet; but, as a matter of fact, their actual rate had been from 4s. to 4s. 7d., while in many instances the net price charged for gas for other than domestic purposes had only been 3s. per 1000 cubic feet. The large domestic consumers had been for the most part supplied at 4s. per 1000 feet; while 600 or 700, whose consumption was infinitesimal, were charged 4s. 7d. The Corporation desired that the price should be between 3s. 6d. and 4s. per 1000 feet under the new arrangement; but to this the Company demurred, on the ground that it would be impossible at this figure to conduct the business without being involved in a loss. The shareholders would not consent, unless forced by Parliament, to the terms proposed by the Corporation. It was further urged that, even if 5s. per 1000 cubic feet were charged, the price would be lower than in most places in Wales, with the exception of such large communities as Cardiff, Swansea, and Newport, where naturally the large demand had the effect of keeping the price low. At Wrexham, the price was also less than proposed in the Bill; but here again the supply was facilitated and cheapened by the proximity of the coal-fields.

The chief witness on behalf of the Company was Mr. Henry Woodall, M.Inst.C.E., who had acted as Consulting Engineer to the Company. He bore out the general argument of the promoters, and entered into details as to the benefits which would accrue to the inhabitants of Aberystwith if the scheme were adopted. The principal points of his contention were that Aberystwith had been very cheaply supplied with gas—practically at 4s. per 1000 cubic feet; but that, in view of future contingencies, the possibility of a rise in the price of coal, the increased cost involved in the extra plant which it was proposed to put down, and the provision of the margin which it was the custom of Parliament to allow in these cases, the raising of the price to 5s. per 1000 feet was only fair and reasonable. Mr. Woodall insisted very strongly on the point that large communities could be charged lower for their gas owing to the great number of customers. Moreover, the cost of supplying gas to Aberystwith was exceptionally heavy, inasmuch as an abnormal number of service-pipes had to be laid for the purpose of meeting the requirements of the large influx of visitors during the summer months; while in the winter the income from the sparsely-populated town was exceedingly meagre. At the same time, the gas-pipes had to be kept in repair, in order to be ready for the demands for domestic purposes in the summer. It was further emphasized by Mr. Woodall that the Company, in addition to their present capital, would be called upon to spend £10,000 as the result of the change it was proposed to make. It was elicited in the course of the cross-examination of Mr. Woodall by Mr. Moreton Smith, that during the last five years revenue to the extent of £1300 had been expended on capital account; and that this had naturally reduced the amount of the dividends paid to the shareholders, which had for several years averaged 8½ per cent. The Company, however, had no reserve fund, and had overdrawn considerably at the bank. The only other witness for the Company was Mr. R. J. Jones, the Secretary. He admitted that, at a special meeting of the Company held recently, a reduction in the price of gas was taken into consideration; but no decision was arrived at.

Mr. Moreton Smith expressed the opinion, in urging the insertion of the amending clauses suggested by the Corporation, that arbitration ought to take place under the Arbitration Act, and not under the Lands Clauses Act, because if the latter were decided upon it would be a serious question with the Corporation as to costs. If a single penny were given above what the Corporation offered, the latter, under the Lands Clauses Act, would be liable to be mulcted in considerable costs. Under the circumstances, too, the Company could well afford to sell gas at 3s. 6d. to 4s. per 1000 cubic feet, instead of 5s. as proposed, and still pay a substantial dividend.

Mr. Edmund H. Stevenson, M.Inst.C.E., was the only witness called on behalf of the Corporation. He explained that he had gone into the matter, and had found that the cost of production, including interest on capital and dividend, did not in 1897 amount to more than 3s. 4d. per 1000 cubic feet. The difference between this and the 4s. 7d. charged in many instances, was practically the amount expended on capital out of revenue. Gas could be sold at 3s. 3½d. per 1000 cubic feet; and in his opinion the price in the Act should be put down at 3s. 6d. per 1000 feet, instead of 5s. This was the most extraordinary case that had ever come under his notice of expenditure of revenue on capital account.

This concluded the case; and the Chairman at once announced that the Committee had decided to pass the Bill, subject to the conditions that the arbitration should be under the Arbitration Act, and that the price of gas should be 4s. 3d. per 1000 cubic feet, instead of 5s.

REDHILL AND REIGATE GAS BILL.

The Redhill Gas Company by this Bill sought reincorporation, with powers of transfer to them of the undertaking of the Reigate Gas Company, Limited. For the purposes of the purchase and the extension of the present works, further capital was asked. Provision was made in the Bill for the formation of reserve, insurance, contingency, and accident funds, and the adoption of the sliding-scale with a "neutral zone" in the price to be charged for gas; fluctuation within the zone not involving any consequent alteration in the dividends paid. The Redhill Company was originally formed in 1860, with a capital of £6000. Of this sum, they had in 1865 spent £5000; and in that year they came to Parliament for incorporation, with authority to supply the parishes of Reigate Old Borough and the Foreign of Reigate. The authorized share and loan capital was £62,500, of which £50,000 is fully paid. The only petition against the Bill was that of the Reigate Corporation, who opposed on the ground that the management of the Company had been extravagant; that the quality of gas supplied was bad; that the proposed standard price was too high compared with the rates charged in other districts of Surrey; and that the probable effect of the amalgamation and absence of competition would be an increase in the charge made for gas. The petition also urged that the undertakings of the two Companies ought rather to be transferred to the Corporation, as the municipal authority of

Reigate and Urban Sanitary Authority; and they undertook to bring in a Bill for this purpose next session.

Mr. Balfour Browne, Q.C., Mr. Claude Baggallay, and Mr. Radcliffe appeared for the promoters of the Bill; Mr. J. D. Fitzgerald, Q.C., and Mr. Arthur Du Cane represented the petitioners.

It was stated in support of the Bill that the Redhill Company was originally formed in 1860 with a capital of £6000. In 1865, having spent £5000 of this amount, they came to Parliament, not only for leave to raise further capital, but also to place themselves under statutory obligations. The Company obtained leave to raise £50,000 capital, with borrowing powers to the extent of £12,500. At that time there was in existence a Company called the Reigate Gas Company, supplying Reigate and a certain area round the town; but though Parliament had given the Redhill Company statutory powers to supply gas, not only in the surrounding districts, but also within the area of the Reigate Company, an agreement was come to between the two Companies by which each undertook not to invade the territory of the other. As the Reigate Company had been established 22 years before the Redhill Company obtained their powers, and even before the latter Company were supplying the outer district, it had been considered only just that the former Company should be left undisturbed. This agreement had worked harmoniously until the year 1897, when, in consequence of small encroachments, the Redhill Company gave notice of their intention to terminate it. Even then the Redhill Company, though they had the statutory right to compete with the Reigate Company, thought it fair that, as they were going to exercise their statutory right, they should, instead of competing, buy the Reigate Company out. Another small Company had been formed to supply Horley, which was also within the statutory limits of the Redhill Company, who, however, as the Horley district was a long way from their mains, did not oppose. Under their Act, the Redhill Company were entitled to charge 5s. 6d. per 1000 cubic feet for gas; the present charge being 3s. 6d. The Reigate Company, who supplied a very compact district, were charging only 3s. 4d. per 1000 cubic feet. The Reigate Company had agreed to sell their undertaking to the Redhill Company on the basis of £175 of 7 per cent. stock for every £100 of capital held. It was proposed in the Bill that the Company should have a standard price, with what was called a "neutral zone." The charge for Redhill and Reigate would, under the amalgamation, be the same, with a differential rate of 6d. per 1000 cubic feet extra for outlying portions of the area. The standard price for gas in the inside areas was to be 3s. 4d. to 3s. 8d. per 1000 cubic feet; the difference between the two prices being the "neutral zone." Fluctuations within this "neutral zone" were not to affect the dividends paid. If, however, the charge went above 3s. 8d. per 1000 feet, dividends were to be reduced; and if it went below 3s. 4d., they were to be increased. The charge for the outside areas was to be 3s. 10d. to 4s. 2d. per 1000 cubic feet. It was to the interest of the Company that they should keep their rates as low as possible, because high charges lost consumers. In this case, the consumers were doubly protected. In Reigate and Redhill, the Corporation had obtained a Provisional Order for an electric light installation, which would, if put into force, have the effect of reducing the price of gas. It was not desirable, in the interests of the consumers, that both the gas and electric lighting undertakings should be in the hands of the Corporation. Having regard to the exceptionally prosperous condition of the Reigate Company, the amount which was proposed to be given for the undertaking was not an unfair one. The Redhill Company had a considerable amount of money to spend almost immediately; and therefore they proposed to increase their capital by £87,000, £35,000 of which would go to the shareholders of the Reigate Company. The application of the auction clauses operated in inducing a company to keep their capital account as low as possible; and unity of management would result in economy in working expenses. The only official complaint which had been made against the Company was dated Feb. 7, 1898, and was obviously formulated for the purpose of opposing the Bill. With regard to the contention of the petitioners that the public benefit resulting from the competition of the two Companies would be lost, there was no competition now, as they were under agreement not to compete. The Corporation should not be allowed to purchase the undertaking of the Redhill Company as it was not a gas-works within their district. If the Committee rejected the measure, in order that the Corporation might introduce a Bill next session for the purchase of the Company, they would be deciding that purchase was a right thing without having the Purchase Bill before them.

The witnesses who were called for the Company, included Mr. Joseph Hepworth, M.Inst.C.E., Mr. Corbet Woodall, M.Inst.C.E., and Mr. George Livesey. Their evidence went to show that the Company had been well managed in the past; that the growing needs of the district would involve extensive outlay on a new site and retort-house, the extension of mains, the introduction of prepayment meters, and other capital expenditure; and that, on the basis of the present increase in consumption, the whole of the capital asked for in the Bill would be required within the next twelve years. Mr. Livesey thought, however, that as both Companies had been paying 10 per cent. dividends at charges of 3s. 4d. and 3s. 5d. per 1000 cubic feet, the 3s. 8d. limit was too high.

At the conclusion of the evidence for the Company, the Chairman said the Committee had decided that if the Bill proceeded it must be on the condition that the Corporation should have the option to purchase, and that the standard price for gas should not exceed 3s. 4d. per 1000 cubic feet in the inside district, and 3s. 10d. in the outside area. Mr. Balfour Browne said the Company were willing to give up the neutral zone; but the purchase clause was a much more serious matter. The Reigate Company had consented to withdraw their Bill on the strength of the bargain they had made with the Redhill Company; and they were entitled to withdraw from the bargain if the Bill were not passed. Time was given to consider the position, and the Committee adjourned. On the Bill again coming before the Committee, it was withdrawn.

Opposition to The Gaslight and Coke Company's Bill.—The Holborn District Board of Works have urged the London County Council to oppose the Bill of The Gaslight and Coke Company, unless certain terms and conditions favourable to the interests of the public are inserted. They communicated with the St. Pancras Vestry on this matter, and stated what they had done; and the Parliamentary Committee of the latter body, on Wednesday last, decided to follow their example.

HOUSE OF COMMONS COMMITTEE.

(*Before Sir* J. Kitson, *Chairman, Captain* Pirie, *Mr.* Baldwin, *Mr.* E. R. P. Moon, *and Mr.* Bonham Carter, *Referee.*)

The above-named Committee, to whom had been referred the Bills in Group A—comprising the Whitwick and Coalville Gas Bill, the Northam Urban District Water Bill, the Frodingham Gas Bill, the North Warwickshire Water Bill, the Hartlepool Gas and Water Bill, the St. Anne's-on-the-Sea Gas Bill, and the York United Gas Bill—commenced their sittings on Tuesday, the 15th inst.; the first Bill taken being the

WHITWICK AND COALVILLE GAS BILL.

By this Bill the Whitwick and Coalville Gas Company, which was formed in 1859 for the supply of the parishes named with gas, seek to be dissolved and re-incorporated with powers over an extended district. The proposed capital of the Company is £15,000, of which £8000 represents the share capital, £2000 the amount expended out of revenue on improvements, and £5000 additional capital. The Bill contains the usual auction clauses, and provides for standard dividends and a standard price of gas of 4s. 6d. per 1000 cubic feet. It contains also provisions for the formation of a renewal fund to an amount not exceeding £2000 by annual contributions of 1½ per cent. of the paid-up capital, an insurance fund, and a reserve fund out of surplus earnings after the appropriation of the necessary amount to pay the authorized dividends. The only petition against the Bill was that of the Coalville Urban District Council, who opposed on the ground that they were, under the Public Health Act, the proper lighting authority for the district; and they submitted that the gas supply should be in their hands. Moreover, they were prepared, on proper and fair terms, to purchase the undertaking of the Company. In any case, they urged that the Bill was unnecessary; its sole object being to enhance the selling value of the undertaking with a view to its purchase by the Local Authority.

The case for the Company was conducted by Mr. Claude Baggallay, Q.C., and Mr. Frere; that for the petitioners, by Mr. Balfour Browne, Q.C., and Mr. Ram.

It was contended for the Company that, in order to meet the growing demands of the district, it was expedient that the works should be improved and the mains extended, and that for this purpose additional capital should be provided. The Company had been supplying the district for nearly forty years; and the price charged for gas had been constantly decreasing. A certain amount had been applied to capital purposes out of revenue; and this it was proposed to capitalize. The Bill, if passed, would release the Company from their present position of being dependent on the good-will not only of the District Council, but also of the authorities outside the District Council's area, and give them statutory power to lay mains and pipes, and for this purpose to break up streets. The effect of the re-incorporation of the Company would be to define the district, while placing them under obligation, to which they were not at present subject, to supply gas to anybody, on the conditions laid down in the General Acts, also to impose obligations with regard to the illuminating power and pressure of the gas supplied, and limitations as to the division of the profits. It was not denied that, under section 162 of the Public Health Act, a local authority could provide for the lighting of their own district where no company having statutory powers existed, or that, if there were a limited company supplying the district, the local authority could, by agreement, purchase the undertaking. But the Act did not constitute an urban district council the lighting authority. The power was only permissive. For nearly forty years the Company had been supplying the district without any complaint on the part of either the Local Authority or the consumers; and only once during this period had the former mooted the question of purchasing the undertaking. The terms asked by the Company had, however, not been entertained; and the matter had fallen through. Compulsory purchase could only be justified by the existence of special circumstances justifying special legislation.

For the Company, Mr. Alfred Colson, M.Inst.C.E., Gas and Electric Lighting Engineer of the Leicester Corporation, was called to show that the Company had been well managed, that the quantity of gas supplied was an increasing one, and that the charge had been lowered. With regard to a contention of the petitioners that, as the works were in a colliery district, the charge ought to be reduced by at least one-half, he gave evidence that the Leicestershire coal was not suitable for their purposes, and that they had to go to Yorkshire or Derbyshire for it. Taking all the circumstances into consideration, he considered that 4s. 6d per 1000 cubic feet was a fair charge.

Mr. Colson was followed by Mr. Edmund H. Stevenson, M.Inst.C.E., who considered that, having regard to the growth of the undertaking and the large increase in the consumption of gas during the past ten years, £5000 of additional capital was a very moderate amount to ask for. In his opinion, nearly £3000 had been spent out of profits for capital purposes. On the basis of the accounts for 1897, and after making allowance for the unusual amount spent on renewals and improvements in that year, Mr. Colson and himself made out that the price to be charged for gas in order to enable the Company to declare the standard dividends and pay their way, would be 4s. 3½d. per 1000 cubic feet. It was the usual practice to allow a margin somewhat above the actual price charged, in order to provide for contingencies.

With reference to a remark of Mr. Baggallay that the renewal fund clause was introduced to supply an omission in the Model Bill, Mr. Bonham Carter pointed out that Parliament looked with great distrust on any extra charges made on a company anticipating the division of profits in the future. Mr. Balfour Browne said that, as far as he could see, there was in principle no objection to this fund. The company were bound to keep their hereditament in an efficient condition; and whether this was done out of the annual expenses or out of the renewal fund did not matter one bit to the consumers. He thought the clause was fair and reasonable, though it was a new one.

On behalf of the Urban District Council, Mr. Balfour Browne said he did not propose to call any witnesses. As the complaints against the Company had not been specifically set out in the petition, he accepted the Chairman's ru'ing that he was not entitled to go into them. Therefore, for the purposes of his remarks, he would assume that the Company had

been doing their duty by the consumers in the district, and that the works were in good condition and well managed. But even assuming all this, he would ask the Committee to come to the conclusion that they would be doing very serious injury to the consumers if the Bill were allowed to pass. The Local Authority he represented was only created in 1892; and immediately after its formation it had approached the Company with the desire to purchase the works. One principle laid down in the Public Health Act was that a local authority such as the one in the present case was to be entitled to supply gas in their district if there were no company authorized by Parliament to furnish such supply. This was general law. At the same time it would be grossly unfair for a local authority to use funds supplied by the public to compete with a non-statutory undertaking such as this. It would ruin the company; and he did not think they should be ruined. He had always said that no local authority should be allowed to supply gas, though it might do so under the General Act, unless it was prepared to give a fair purchase price for the existing non-statutory concern. The Local Authority in the present case had entered into negotiations for the purchase of the Company's undertaking; but they had fallen through. Then the Company came forward with their Bill, which he contended ought to be rejected, not only on general principles, but on the ground of precedent. They were not applying to Parliament *bonâ fide;* they were doing it simply to enhance the selling value of the property against the Local Authority. Its effect would be to make the undertaking worth four or five years' more purchase, without a single penny having been added to the inherent value. The Company would be more valuable simply because by the Bill they would have taken away from the Local Authority the right to supply gas. He ventured to say the Committee would not, for nothing, take away the right of the Local Authority and give the Company five years' extra purchase, which would have to come out of the pockets of the ratepayers. He did not know a single case of a non-statutory company having been turned by Parliament into a statutory one except with the insertion of a certain clause into the Bill where there had been negotiations for purchase, and where the local authority, in opposing the Bill, said they were willing to buy. He was quite prepared in this case to say that the District Council were agreeable to purchase on liberal terms the works as they stood to-day. There was the well-known case of Cowes, in which exactly the same arguments were used as in the present instance; but Parliament had inserted clauses to the effect that if the District Council should, in any of the next three sessions, introduce a Bill empowering them to purchase the undertaking of the Company, the latter should not oppose except in so far as might be necessary to secure the insertion therein of clauses to protect their interests, and stipulating that if, failing agreement as to the purchase price, the matter came before an arbitrator, he should, in assessing the purchase price, not have regard to the fact that the Company was incorporated by Parliament, but should add to the amount of his award the cost of obtaining the Act. This had been done in the Queenstown and other instances. In the case before them, the Local Authority were perfectly willing that the Committee should either reject the Bill or pass it with the addition of such a clause as he had described. They would accept the Cowes clause. The Company did not want more capital; and they had retort power in excess of their present requirements. The only people to interfere with them were the Local Authority, who had never troubled them in the past, and would not do so in the future; and the whole object of the Bill was to get extra purchase-money.

The Committee passed the preamble of the Bill conditionally on the insertion of the Cowes clause, with the following observation: "That the Council shall introduce a Bill into Parliament and *bonâ fide* promote the same in the next session of Parliament; and the Company shall not oppose, except in so far as may be necessary to secure the insertion of clauses to protect their interests." The renewal fund was allowed, subject to the condition that it should not exceed 5 per cent. of the capital, or £1000. The standard price was fixed at 4s. 2d. per 1000 cubic feet.

The clauses were then considered, and modifications introduced in accordance with the decisions of the Committee, which then adjourned till the following Tuesday (to-day).

HOUSE OF COMMONS COMMITTEE.

(*Before Mr.* A. Brown, *Chairman, Sir* J. Woodhouse, *Mr.* Bathurst, *and Mr.* Brigg.)

The above-named Committee, to whom had been referred the Bills in Group B—comprising the Enfield Gas Bill, the Norwich City Water Bill, the Southend-on-Sea Gas Bill, the Thanet Gas Bill, the Tottenham and Edmonton Gas Bill, and the Crawley District Water Bill—commenced their sittings last Tuesday.

It was announced that the opposition to the first and third Bills in the group—the Enfield and Southend Bills—had been withdrawn. The Committee therefore proceeded with the consideration of the

NORWICH CITY WATER BILL.

The City of Norwich Water-Works Company, which was formed in 1849 for the supply of water to Norwich, by the above Bill seek further capital, and powers for the construction of new works, comprising an extension of the filter-beds, additions to the pumping-station at Heigham, and a service-tank at Mousehold, the estimated cost of which, including the 27 acres of land to be taken compulsorily, is £64,550. The Bill proposes to increase the existing authorized £200,000 of share capital, by a further £100,000, to be issued under the auction clauses; and the £60,000 of loan capital by an additional £25,000, in order to make and maintain the subsiding reservoirs and filter-beds, service-tanks, and subsidiary works mentioned in clauses 45 and 46 of the Bill. Authority is also asked to pay back-dividends on the capital raised under the Bill; and it is proposed to issue this capital at 6 per cent. on ordinary, and 5 per cent. on preference shares.

The only petition against the Bill was that of the Norwich Corporation, who opposed it principally on the ground that the granting of further capital and other powers to the Company would be prejudicial in the probable near event of the acquisition of the Company's undertaking by the Corporation, inasmuch as it would increase the purchase price without increasing the income. It was asserted that the capital asked for was excessive, that the proposed new works were not immediately necessary, and that the cost of opening the streets for laying down more mains would throw great expense on the Corporation. They also stated that in some parts of the district, particularly at Mousehold, the service of the Company was not satisfactory; and they complained of the pollution of the supply at Drayton. They asked for the adoption of the Duckett, or slop closet, in the poorer parts of the district, in place of the ordinary ashpit or the pan closet. They also objected to the payment of back-dividends.

Mr. Balfour Browne, Q.C., Mr. J. D. Fitzgerald, Q.C., and Mr. Ram conducted the Company's case; that for the petitioners was in the hands of Mr. Freeman, Q.C., Mr. Rigg, and Mr. E. E. Wild.

It was contended for the Company that the proposed new works were absolutely necessary, owing to the rapid growth of the population of the city, which in 1851 was 68,000 and was now 112,000. In support of their case the General Manager (Mr. John Ayris, M.Inst.C.E.), the Consulting Engineer (Mr. Charles Hawksley, M.Inst.C.E.), Sir F. J. Bramwell, Bart., and Mr. E. A. Eaton, Assoc.M.Inst.C.E., were called. They gave evidence generally as to the excellence and cheapness of the Company's supply, the great desirability of the proposed new works, and the necessity for the amount of capital asked for, which would not only enable the Company to carry out the proposed works at the estimated cost of £64,000, but would leave a balance for any necessary additions thereto, and place them in a position of not being compelled to apply to Parliament for further capital during the next fifteen years. They strongly condemned the Duckett closet, on the ground of its tendency to cause waste of water; and they recommended the adoption of the double-barrel or syphon cistern, with the two-gallon supply.

For the Corporation, it was stated that the main object of their appearance in opposition to the Bill was to ask Parliament to give them their assistance, as far as they could, to the acquisition of the undertaking of the Company for municipal purposes. Negotiations were begun in 1891, when a Committee was appointed to endeavour to purchase the water-works. They were carried on till February last year; and if the Corporation failed to come to terms with the Company, they intended to introduce a Bill next session for compulsory powers to acquire the undertaking. Several witnesses—including the City Engineer (Mr. A. E. Collins, Assoc.M.Inst.C.E.), Mr. E. Wild, J.P., Mr. Havelock, J.P., Mr. Taylor, and Mr. W. Santo Crimp, M.Inst.C.E.—were called in support of the petitioners' case. They gave evidence as to pollution of the river at Drayton, and insufficient pressure at Lakenham; and they spoke generally in favour of the adoption of the Duckett closet. They also expressed the opinion that it would be most desirable that the water-works should be in the hands of the Corporation, who would, they said, be better able to deal with the provision of water for fire-extinguishing, and to judge of the best sanitary systems and appliances to adopt.

The Committee passed the preamble of the Bill, with the following alterations: The capital to be reduced from £100,000 to £60,000, with borrowing powers in proportion—making with the existing £15,000 of loan capital £90,000; the word "additional" to be inserted before "capital" in clause 18, to make it clear that the power sought by the Company to pay back-dividends should only apply to "the additional capital" raised under the Act. The Committee did not interfere with the decision of the Company as to fittings and slop closets. The fifteen years in clause 9, within which the Company may apply to Parliament for further powers, was reduced to ten years. With regard to clause 15, which embodied recommendations of the Local Government Board with regard to the power to prevent the contamination of the sources of supply of water for domestic use, the Committee thought it very desirable (this question being raised in four or five Bills now before Parliament) that it should receive uniformity of treatment, and that the clause should be struck out, on the understanding that a clause would be proposed in the House of Lords to deal with the matter.

The Committee then adjourned until the following Tuesday (to-day).

Proposed Purchase of the Tramore Gas-Works by the Waterford Guardians.—At a representative meeting of the residential ratepayers of Tramore held a short time since, a resolution was adopted, practically unanimously, to petition the Waterford Board of Guardians to take steps to acquire the gas-works at Tramore, and light the town. The works are in private hands; and Mr. G. Donaldson, of Waterford, has reported in favour of the project for their transfer to the Guardians. He thinks that, with good management, they should pay well. The make in the twelve months ending Feb. 1 was 535,600 cubic feet; and the price charged is 5s. 10d. per 1000 cubic feet. It is thought that a loan of £1000 would cover all the expenses of purchase.

Gas, Water, and General Investment Trust.—The report of the Directors for the financial year ended the 28th of January last states that, after debiting the revenue account with interest on the debenture stock and all expenses, and crediting it with the sum of £1964 brought forward, there remains a balance of £20,756, out of which an interim dividend for the six months to July 28, 1897, at the rate of 4½ per cent. per annum on the preferred stock, amounting to £7308, was paid in August last. The Directors recommend further dividends at the rate of 4½ per cent. per annum on the preferred stock, and at the rate of 3 per cent. per annum on the deferred stock for the six months ended Jan. 28, amounting to £10,556. (The dividend on the deferred shares is reduced by one-half as compared with the previous year.) This will absorb £17,864, and leave a balance of £2892 to be carried forward. The profit on sales during the year, including underwriting commission, is £8789, which has been credited to the suspense account for the adjustment of securities. This, with the balance of £277 brought forward from the previous year, makes the amount at the credit of that account £9067. After debiting £4902, the loss made on changes of certain investments, &c., there remained a balance of £4164. Of this amount, £3852 has been applied to writing down the price at which several investments stand in the books of the Trust; and the balance of £312 has been carried forward to the credit of the account. The securities stand in the books at cost prices, less the sum of £96,817 already written off out of realized profits. Many of the securities held continue to be much depreciated in value; and the Directors anticipate that further provision to a considerable amount will have to be made in connection with securities now held. The report was adopted at the meeting of shareholders last Friday.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, March 18.

(*Before Mr. Justice* NORTH.)

Attorney-General (at the Relation of the Swansea Gas and Coke Company) v. Mayor, &c., of Swansea.

This was a motion for an injunction to restrain the defendants from applying the borough funds or borough rates towards the costs or expenses of opposing a Bill which the Swansea Gas Company are promoting in the present session, unless and until such consents have been obtained as are indicated in the Borough Funds Act, 1872.

Mr. SWINFEN EADY, Q.C., Mr. MACMORRAN, Q.C., and Mr. KNOWLES CURRIE appeared for the plaintiffs; Mr. VERNON SMITH, Q.C., and Mr. R. J. PARKER represented the defendants.

Mr. SWINFEN EADY having read the notice of motion,

Justice NORTH asked what were the consents referred to.

Mr. SWINFEN EADY said they were practically the consent of the ratepayers at a special meeting to be duly called, and the consent of the Local Government Board. The plaintiffs were a Company incorporated by an Act of Parliament of 11 Geo. IV., and were authorized to make and supply gas. The defendants were the Corporation of Swansea; and they also had certain powers, under a Local Act, of supplying gas for lighting the streets and selling the surplus to consumers. The plaintiffs were promoting a Bill in Parliament; and defendants, without in any way communicating with the plaintiffs, at the last moment presented a petition against it, asking to be heard by counsel and witnesses in the usual way. On this coming to the knowledge of the plaintiffs, they immediately had advice, communicated with the Attorney-General and obtained his fiat, issued a writ, and served the notice of motion. It was not disputed that the defendants intended to apply the borough funds in fighting the plaintiffs in Parliament; and this was not a purpose to which they could lawfully apply them, unless they proceeded in the special manner pointed out by the 35 and 36 Vict., cap. 91. This Act was passed in 1872; it having been decided by the Court of Queen's Bench the previous year, in the Sheffield case, that the expenses of opposing parliamentary proceedings were not properly payable by a corporation out of the funds under their control. The Act, however, authorized it to be done under certain circumstances. The learned Counsel then read the principal sections, which provide for the insertion of advertisements in the local papers, certain notices being given, and resolutions being passed.

Justice NORTH said he should like, before going any farther, to know what was the question at issue.

Mr. SWINFEN EADY said he did not understand it would be contended that these formalities had been complied with; but the defendants were going to say that they were within a decision of Sir George Jessel in the Brecon case.

Mr. VERNON SMITH said he did not suggest that there had been an approval by the ratepayers, but that, having regard to section 8 of the Act, and to the decision to which his friend had referred, it was not for his Lordship to say now that the defendants should be restrained. The defendants' rights being interfered with by the plaintiffs' Bill, they had a right to oppose it; and, if they turned out to be in the wrong, then the payment of the expenses out of the borough funds might be stopped. The section mentioned preserved the rights of the defendants; it provided, in effect, that if, but for the Act, the borough funds might have been applied to a particular purpose, the Act should not prevent it.

Mr. SWINFEN EADY said his contention was that the defendants' rights and privileges were in no way interfered with by the plaintiffs' Bill. It was a Bill dealing practically with internal management; and he would presently refer to it more in detail. He would first read the affidavit of Mr. Thornton Andrews, the Engineer and Secretary of the Company. This affidavit, after referring to the incorporation of the Company, set forth that by a Local Act, 7 and 8 Vict., cap. 102, the Improvement Commissioners of Swansea, predecessors of the defendants, were authorized to make gas for the purpose of lighting the streets; but nothing in the Act was to prejudice the plaintiffs' rights as defined in their Act. So that in effect both parties had concurrent powers. In practice, however, the defendants had not made gas themselves, but purchased it from the plaintiffs. In 1861, the plaintiffs' original Act was repealed by a new Act, by which they were re-incorporated under the same name, but with further powers—their district being extended; and this Act included a clause reserving all the rights of the defendants. The purpose of the Bill now being promoted was to enable the Company to purchase land, consolidate the existing and issue additional capital, supply gas-fittings, &c.; but it did not propose to interfere in any way with the rights, powers, or privileges of the defendants. A copy of the Bill was exhibited with the affidavit. Defendants, by their affidavit, in general terms traversed the statement read, but did not point out how their rights were affected.

Mr. VERNON SMITH, in answer to a question from his Lordship, said the defendants' point was that their position would be affected in the first place by a proposed variation in the terms on which gas was to be supplied. The Company were bound to let the Corporation have gas at a price to be determined in accordance with the Gas-Works Clauses Act, under which it was to be decided, in case of differences, by arbitration, having regard to the price charged to other consumers. By their new Bill, the Company proposed to remodel their charges. At present there was a maximum charge of 3s. 6d. per 1000 cubic feet; but under the Bill the price must be varied according to the dividend, and go above 3s. 6d. The second point was that there was no clause saving the rights of the defendants, as in the former Acts.

Justice NORTH suggested that this might be because the Bill did not interfere with them.

Mr. VERNON SMITH said no doubt that would be a question which might have to be discussed before the Parliamentary Committee. Under section 161 of the Public Health Act, a local authority could only supply gas or water where there was no other public body or company doing so. They could not supply it themselves unless they had concurrent powers, as his friend had very fairly said. At present they had concurrent powers. Whenever a Bill had been passed in favour of the Company, there had always been inserted a clause saving the rights of the Corporation; but in this Bill there was nothing of the sort. These were the two main points which defendants said entitled them to oppose the Bill.

Mr. SWINFEN EADY said that in 1888 there was an Act or Provisional Order in which there was no saving clause, because it was unnecessary; and they said it was so here, because the Bill did not affect the rights or powers of the Corporation in any way. With regard to price, they were entitled to be charged the lowest figure paid by any private consumer.

Justice NORTH: A "most favoured purchase" clause?

Mr. SWINFEN EADY: Yes. Counsel went on to say that Mr. Andrews, in his affidavit, stated distinctly that it was wholly unnecessary that any such clause as was referred to in the petition should be inserted, as the Bill did not affect the right of the defendants to construct gas-works, nor did it contain anything which would interfere with them. He said it was untrue that there were any clauses in the Bill which prejudicially affected any rights or interests of the defendants. He further pointed out that the opposition must entail very heavy expense, both on the Company and the ratepayers; and that the plaintiffs, being large owners of property, paid rates annually to the amount of more than £1800. He knew of his own knowledge that the opposition of the defendants had not received the sanction of the owners and ratepayers. The Bill was expected to come on for hearing on the 21st inst. Counsel then went through the clauses; pointing out that the Bill gave no power of purchase except by agreement, and it was not proposed to take any of the defendants' land. There was the usual clause restricting the taking of houses occupied by the labouring classes; and another for the consolidation of existing capital, and giving power to raise additional money. The dividend on the consolidated stock was to be 5 per cent., and on the preference stock 4 per cent. The standard price to be charged would be as prescribed by section 28 of the Order of 1888—the Provisional Order confirmed by Parliament to which he had referred, in which there was no saving clause—with a proviso that if the price charged in any year should be 1d. above the standard, the dividend should be reduced by 2s. 6d. per cent., and if the price were reduced there might be a corresponding increase in the dividend. There were the usual clauses as to offering the shares by auction or tender, and the application of the premiums. The other clauses had reference to mortgages, interim dividends, the letting of gas-fittings on hire, and so forth; and he submitted, with confidence, that there was nothing in the Bill which affected the rights, privileges, or powers of the Corporation.

Saturday, March 19.

On the hearing of the motion being resumed this morning,

Mr. SWINFEN EADY said he would go to the petition, having already dealt with the Bill.

Justice NORTH suggested that section 9 of the Bill was the only one to which the defendants could in any way take exception.

Mr. VERNON SMITH said there were other sections to which they objected—those which gave power to increase the capital and alter the dividend. The increase in the capital, which would be £202,000, instead of £150,000, would permit of a considerable increase in the reserve fund, which was 10 per cent. on the nominal capital; and thus large sums would be placed to reserve, which at present, after providing the maximum dividend, would have to go in reduction of the price of gas.

Mr. SWINFEN EADY pointed out that if the capital was augmented there would be increased earnings arising from it.

Mr. VERNON SMITH said this was a matter which they were entitled to put before the Committee of the House.

Mr. SWINFEN EADY then went through the petition. The petitioners claimed to represent the consumers of gas in the borough, and among the objections raised was one to the amount of land the Company proposed to acquire—viz., 10 acres, which it was suggested was excessive. They also objected to the clauses for the consolidation and increase of the capital; to the standard price being fixed at 3s. 6d., as by the Provisional Order of 1888, as it is now sold at 3s.; and also that words were not inserted extending the area within which the low standard price was to be charged in the present limits of the borough—this having been enlarged since 1888, and the Company having by the Order the power to charge 5s. per 1000 cubic feet to consumers beyond the limits of the borough as it then existed. They also objected to the sliding-scale, under which the dividend might be increased one-eighth per cent. for every reduction of 1d. per 1000 cubic feet in the price of gas.

Justice NORTH asked what was the objection to this?

Mr. VERNON SMITH said at present the Company could not charge more than 3s. 6d., and all surplus profits, after providing for the reserve fund, must go in reduction of price.

Justice NORTH said he understood the point was that at present surplus profits must go in one direction—viz., in reduction of price—whereas under the Bill they would go in a certain proportion to increase the dividend.

Mr. VERNON SMITH said this was so.

Mr. SWINFEN EADY said his point was that these things did not in any way interfere with the rights, powers, or privileges of the defendants, and could not therefore entitle them to oppose the Bill, except in conformity with the provisions of the Borough Funds Act. He then concluded reading the petition; the only other points of any importance being the claim to have a clause inserted preserving the rights of the defendants, and a suggestion that the accounts of the Company were not properly kept, and that they ought to be made subject to audit by some one appointed by the defendants. There was also the usual complaint in such petitions that the quality and illuminating power of the gas supplied was not as good as it might be. He submitted that there was nothing whatever alleged in the petition which entitled the defendants to oppose the Bill without observing the statutory provisions.

Mr. VERNON SMITH then read the affidavit filed by Mr. John Thomas, the Town Clerk of Swansea, which was practically on the same lines as the petition, but on some points going rather more into detail. He also drew attention to a Standing Order of the House of Lords which provides that governing bodies or corporations are entitled to appear and oppose any Bill referring to the supply of gas or water without having to prove that their rights would be prejudiced by it; and he said that if the Borough Funds Act had to be complied with before opposing such a Bill, it would cost much more than opposing the measure. In the present case,

he estimated that if a poll were demanded the expense would be £600, which would be far in excess of the cost of opposing the Bill in Parliament. In conclusion, he referred to the Municipal Corporations Act, 1882, and suggested that if the defendants were wrong in their opposition to the Bill, the proper course was for the parties aggrieved to apply to the Court of Queen's Bench for a writ of *certiorari* as provided by the Act, to prevent the expenses being paid out of the rates.

Mr. SWINFEN EADY said this was the whole of the evidence; and he submitted that the case was quite plain. The defendants had not shown a single point in which their rights or duties would be interfered with by the Bill. If the defendants' contention were sound, every corporation would be able to say, whenever a gas company promoted a Bill, that they were outside the Borough Funds Act. The Standing Order which had been read showed that they had *locus standi* to oppose a Gas and Water Bill; and this he did not dispute. The case of *Regina v. Mayor, &c., of Sheffield* (L.R. 6, Q.B., 652) was a case of the Corporation opposing a Water Bill, where they undoubtedly had *locus standi*, but the Court of Queen's Bench granted a writ of *certiorari* to prevent the expenses being paid out of the rates; and it was in consequence of this decision that the Borough Funds Act was passed the following year. Having referred at some length to this case, and read portions of the judgments, the learned Counsel said the defendants appeared to rely on the judgment of Sir G. Jessel, in the Brecon case (10 Ch. Div., 204), and he would therefore refer to it. He had only partially stated the facts, however, when

His LORDSHIP said he could not go any further into the matter that day; and the motion accordingly stood adjourned until next Friday.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Thursday, March 17.

(*Before Justices* WRIGHT *and* DARLING.)

Southwark and Vauxhall Water Company v. Hampton Urban District Council.

This was an appeal on a case stated by Magistrates* with reference to an order made on the appellants for the payment of rates; the question being whether a reservoir belonging to the Company is "land covered with water" within the meaning of section 211 of the Public Health Act, 1875, which exempts such land from rating to the extent of three-fourths of its value.

Mr. CRIPPS, Q.C., and Mr. W. C. RYDE appeared for the appellants; Sir EDWARD CLARKE, Q.C., Mr. C. MUNRO, and Mr. PERCIVAL CLARKE represented the respondents.

Mr. RYDE (in the absence of his leader when the case was called on) said that when before the Magistrates he stated what appeared to be the common-sense view—that this was land covered by water; and he cited a case which he submitted was clearly in his favour. But the Magistrates seemed to find no difficulty in holding that it was not land so covered, and that they were at liberty to over-rule the decision in the Court of Queen's Bench.

Justice WRIGHT said he supposed the soil of the reservoir belonged to the Company.

Mr. RYDE said it did, absolutely.

Justice WRIGHT: Therefore it is land.

Mr. RYDE said he believed the Magistrates considered that the reservoir was in the nature of a tank. He then proceeded to read the case, from which it appeared that the validity of the rate was admitted; that the appellants were rated in respect of a portion of a large reservoir at Sunnyside, the other portion of it being in the parish of Sunbury; that the net annual value was £1940; and that the sums of £97 and £40 8s. 4d. were charged in respect of such value. The appellants had tendered £34 7s. 1d. —being the amount of rates calculated on one-fourth only of the net annual value; but the respondents would not accept it. The reservoir covered an area of 10½ acres, with a 9-inch bed of concrete at the bottom, and was surrounded by an embankment for the purpose of keeping in the water, which varied in height from 10 to 18 feet. The total depth was about 35 feet. It was used simply for storing water, with which it was permanently covered; only being emptied for cleaning purposes. This had been done once since it was constructed three years ago; and it would require to be done about once in two years. The cost of construction was £63,000. Appellants had been rated in respect of the portion which was in Sunbury Parish at one-fourth of the net annual value; and it was the practice to rate other water companies in like proportion in respect of similar reservoirs. Respondents held that it was not land covered by water, but was in the nature of a vessel built of cement for the purpose of storing water, and was therefore properly rated at the full net annual value. The learned Counsel then proceeded to cite the cases of Birmingham and the East London Water Company, and pointed out that the Public Health Act, 1875, was passed after judicial decisions had been given as to the meaning of the words "land covered by water," and therefore the Legislature must be taken to have intended the same meaning to attach to them in that Act.

Friday, March 18.

On the resumption of the proceedings this morning,

Sir E. CLARKE said he appeared in support of the Magistrates' decision, which was, he submitted, given on a matter of fact; and in the statement of the case they had given the reasons which led them so to decide it. They found that the reservoir was not land covered with water, "the same being in our judgment, by reason of its construction as aforesaid, in the nature of a vessel built of cement for the purpose of storing water, partly embedded in land, and was therefore rightly rated at its full value." It was not, in the ordinary sense, "land covered by water." It was a gigantic tank made of cement, and standing several feet above the ground, and holding a very large quantity of water many feet deep, and above the surface of the ground. It had been constructed at a cost of £63,000 as an artificial receptacle for water; and upon this the Magistrates found, as a fact, that the thing which was rated was not land covered by water, but an artificial thing. It was very much like a gasholder; and nobody would ever dream of calling a gasholder land covered by gas. The reservoir held water in the same way that a gasholder held gas. He should have suggested that this was a question of fact upon which the Magistrates' decision would be final; but there was no doubt that the two cases to which attention had previously been called were against him on the point. This was a matter of extreme and growing importance, because it was quite obvious that, whereas in certain riverside places practically half the area of the parish was taken for the purpose of accommodating reservoirs of this kind, and houses were pulled down in order to build them, and though the appellants were a Company who for their own purposes were expending large sums of money in making these things, the other half of the parish had to bear seven-eighths of the rating. It was therefore desired by the parishes, and also, he believed, by the Water Companies, that this question should be completely discussed and decided.

After some further argument,

Justice WRIGHT said there was no doubt this was a very important question, and probably they should not be wrong in saying that, if they had to decide it without regard to previous cases, they might have been inclined to take a different view from that which the existing authorities had taken. They were, however, bound by them at present, and must follow them; and Sir E. Clarke was right in saying they could not be distinguished from the present case without casuistry. They did not think the Magistrates meant to raise the question here only as one of fact, but intended also to raise a point of law. The appeal must be dismissed with costs; but they would allow leave to appeal.

Justice DARLING concurred.

* See "JOURNAL," Vol. LXX., p. 953.

NEWCASTLE WINTER ASSIZES.—Saturday, Feb. 26.

(*Before Mr. Justice* RIDLEY *and a Jury.*)

Walkers, Parker, and Co., Limited, v. Newcastle and Gateshead Gas Company.

In the "JOURNAL" for the 8th inst. a short report appeared of the above-named case, which was an action for compensation for damages sustained by the plaintiffs owing to the alleged negligence of the defendants. The firm in question, who are lead manufacturers, asserted that the defendants, who were possessed of large quantities of gas, permitted it to escape, whereby on Dec. 4, 1896, an explosion was caused which did damage to the plaintiffs' works. Another count in the statement of claim alleged that the defendants were guilty of negligence in connection with the custody of the gas. The defendants did not admit that they permitted large, or any, quantities of gas to escape; and they said that if any such escape occurred, it was due to causes not attributable to their negligence. They further said that no damage had been suffered by the plaintiffs. The following is the more extended report of the proceedings which it was stated would be given

Mr. STRACHAN, Q.C., and Mr. MUNDAHL appeared for the plaintiffs; Mr. E. TINDAL ATKINSON, Q.C., and Mr. T. WILLES CHITTY represented the defendants.

Mr. STRACHAN, in opening the case, said the plaintiffs' works were at the Shot Factory, near the Redheugh Bridge, and almost immediately joined the defendants' premises. On the east the works were bounded by Shot Factory Lane, down which a 3-inch gas-main ran. Almost at the foot of the lane this main joined a very large one running along Skinnerburn Road. This was an old, leaky main, which had, he believed, been in use for some forty years, and had since been renewed. The Shot Factory Lane pipe had been in use for a very long time; and he understood that both it and the Skinnerburn Road main had been allowing gas to escape. In the plaintiffs' works there were numerous underground flues, some used and others disused. There was also a network of drains which were necessary in a place of the kind. This fact would have a great bearing on the evidence to which the Jury's attention would be directed. For some time before Dec. 4, 1896, there had been a smell of gas in Skinnerburn Road. At the angle of Shot Factory Lane and Skinnerburn Road there were a number of cottages; and in the vicinity, shortly before the explosion, there certainly was a very strong smell of gas, particularly in the yard of one of the cottages, occupied by Mr. Magnay, who was a foreman at the lead-works. When the works were closed at five o'clock on the above-named day, everything was in order; whereas at six o'clock on the following morning, when the men came to work, there were eight or nine indications of explosions having happened. Heavy walls were cracked from top to bottom; heavy wooden doors were jammed so that they could not be opened; paving flags were tilted up; there was an upheaval of the cement; a tramway turntable had been dislodged; stones in the high wall of the Skinnerburn Road were loosened, and the cement was lying on the pavements; plaster and lime had been shaken off the roof; the seating of the steam-engine was injured; and other damage was done. Counsel concluded by saying that nothing else would account for the damage caused except the explosion which the plaintiffs said had happened.

The following witnesses were then called:—

Henry Magnay said he lived with his father in one of the cottages near the plaintiff's works, and at about 8.45 on the evening of Dec. 4, 1896, he went into the water-closet, struck a match, lighted his pipe, and then threw the match into the pan. Immediately there was a flash and a loud report, but he was not in any way injured.

Thomas Magnay, foreman at the works, and father of the previous witness, said he was in the house at the time of the explosion, and he had never heard such a loud report, not even from a cannon. The house shook. He also spoke of the damage done in the wash-house, where the ceiling had come down, the door would scarcely open, and the gully-trap was blown up; also as to cracks in the wall which he had never seen before, and which appeared to be new, and flags being tilted up. In Shot Factory Lane there was a very strong smell of gas on the afternoon of the explosion; and there had been a smell for years coming out of the drain gratings in Skinnerburn Road.

Robert Baty, a tenant of the cottages, said he heard the report of the explosion, which reminded him of a heavy "brattle" of thunder; and he found his water-closet seat in pieces. He had noticed smells of gas for some time before, but had not made any complaint.

Justice RIDLEY asked if it was necessary to go into so much detail.

Mr. STRACHAN said he wanted to prove that the damage done at the works, though some distance away, was caused by the explosion.

Justice RIDLEY said the present Court would not settle the amount of damages. It was quite impossible for them to say which were old and which new cracks; and it would have to be left to someone else. What they had to do was to say whether or not defendants were liable.

Mr. STRACHAN said that if defendants would admit that the explosion caused all the damage, he would not call more witnesses to prove it.

The FOREMAN of the JURY remarked that the Jury were quite satisfied that there was an explosion.

Mr. TINDAL ATKINSON: Do I understand that the Jury say there was an explosion all over the plaintiffs' works?

The FOREMAN: We have not had sufficient evidence. All we say is that we believe there was an explosion of gas.

Mary Smith, living with her mother in one of the cottages in Shot Factory Lane, said that before the explosion she perceived a very strong smell of gas; but after it the smell was not so bad. When the Gas Company's men were repairing the pipes after the explosion, the ground took fire from a piece of lighted rope one of the men was carrying.

Charles Meston said he had been employed for the past twelve years at the plaintiffs' works as a plumber and gas-fitter, and lived in Skinnerburn Road. He gave evidence as to damage done in the wash-house and elsewhere by the explosion. He did not think there had been any subsidence. He saw the pipes in Shot Factory Lane when they were bared, and they seemed to be rotted and decayed. There had been a smell of gas in Skinnerburn Road before; and the Gas Company's men found a leakage opposite his door. After the explosion, he went round the works with Mr. Charlton, the plaintiffs' Engineer, and found an escape of gas outside the private house; but this had nothing whatever to do with the explosion. He also found an escape of gas into a cellar; and this was still going on. There were no service-pipes in the cellar, but there was a drain. The main sewer ran about 3 yards nearer the river than the gas-main, and the drain from Magnay's water-closet joined it.

In cross-examination, witness said he went round after the explosion with M'Cormack, a pipe repairer in the employ of the defendants, and showed him the cracks in the walls. M'Cormack did not say they were old cracks, and had been there for some years, nor did he suggest anything about them being caused by subsidence; and he (witness) did not say he believed M'Cormack was right, and that it would not be long before the place would be in the river. He had not noticed that the front wall of the cottages in Shot Factory Lane were bulged; and he could not say why they were tied. They were tied when he went into the plaintiffs' employ. He did not know what necessity there was for tying them, but he suspected it was to support the buildings. Plaintiffs' quay wall was piled, and he admitted that he thought this would be done because of the land slipping towards the river. Some photographs, showing cracks in various buildings, having been handed to witness, he further admitted that the cracks were, in his opinion, caused by the sinking and slipping of the ground; and if the ground had slipped, it might be expected to drag and break the pipes in Shot Factory Lane. As a plumber, he was of opinion that the escape from the 3-inch pipe would be sufficient to cause the explosion. A workman called him to look at this pipe when it was bared; but he did not take one of the pieces into his hand to examine it. He formed his opinion as to it being rotted and decayed from seeing it lying on the road. There were service-pipes on plaintiffs' premises, and two or three days after the explosion he noticed a smell of gas from one of them in the road within the gate. It was a 1¼-inch pipe. He bared it for about 12 feet, and found a brass coupling connecting two pipes torn away. The cause of the parting he thought to be due to the slipping of the ground. Photographs of cracks in the buildings being again handed to witness, he said one of the cracks he had noticed getting wider, which he thought was due to the ground slipping.

Justice RIDLEY asked what witness meant by saying he thought there was no subsidence, and then that there was a slipping of the ground.

It was considered that witness had not understood the meaning of the word "subsidence."

Witness (continuing) said he did not know whether or not there was a crack across plaintiffs' cart road—he had not examined it. There were several cracks in their works, and he was not prepared to swear that some in the Pattinson pothouse were not there prior to the explosion. He had not been instructed to make an investigation in the cellar where the gas was escaping; but he was of opinion that it came through a drain. There were service-pipes going into the second storey, but not into the cellar. He found the smell in the cellar about four months ago. He did not give notice to the Gas Company, but to the Manager; and nothing had been done.

Re-examined: When M'Cormack was at the works after the explosion, they had a conversation, and M'Cormack said the Company knew that these pipes were all wrong and that he (M'Cormack) had been working for them 25 years and had always been repairing them.

Mr. *J. Charlton*, the plaintiffs' Engineer, was the next witness. He said the plan put in, with certain points marked, indicated accurately, in his opinion, the places damaged by the explosion; and another plan, which had also been put in, showed correctly the system of drainage so far as he had been able to discover it. He then gave evidence as to the damage done to the machinery, the walls, and the cement floor, and spoke of heavy doors being jambed.

Justice RIDLEY said he did not understand why all these details should be gone into. It was admitted that there had been an explosion.

Mr. ATKINSON said the first point was one of liability. Was there proof to the satisfaction of the Jury that there had been any negligence on the part of the defendants? The bare fact of gas escaping was not sufficient, because the Company were not bound to assure that the gas would always keep in their pipes. Therefore he contended that there must be negligence proved before the defendants were liable. The next question would be as to what damage was done, and how far the effects of the explosion had gone. Someone would eventually have to deal with the question of the extent of damage, if the decision of the Court was against the defendants; and the person would have to say what amount of damage had been done by explosion, and what amount by subsidence.

Justice RIDLEY said the question was what caused the explosion? Did it arise from neglect of leaky pipes, or were they broken by something or other suddenly, and liberation of the gas caused the explosion.

Mr. STRACHAN said he was proving that all the damage claimed for was caused by the explosion; that it could not be subsidence; and that there was negligence on the part of the defendants in allowing the gas to get into the drains.

Justice RIDLEY said it must be proved that the gas got into the drains through negligence.

Witness's examination was continued. He said that there had been subsidences; but there had been no indication of any during the last seven years. In his opinion, it was possible an initial explosion at the cottages would cause damage at the other places some distance away.

Mr. *J. Ferguson*, builder, said it would require a very large subsidence to affect the 24-inch or the 3-inch mains. If there had been a recent subsidence, it would have shown on the quay wall; but there was no indication of this. Photographs of cracks in various buildings were then handed to witness; but he considered them to be old ones.

In cross-examination, witness admitted that, generally speaking, some of the cracks inferred a pulling towards the river; but none appeared to be of recent date. If there was a drag towards the river, there would be a drag upon the joints of the mains.

Mr. *R. Mack*, auctioneer and valuer, said he had extensive experience in explosions and subsidences. He visited the lead works on Jan. 14, 1897, and was quite able to distinguish the old from the new cracks. He saw signs of old subsidences, but did not consider the recent cracks and damage consistent with subsidence—they were attributable to the explosion. There had been extensive dredging operations in the river, and more especially since Dunston Staiths were opened in 1892.

Mr. *J. Smart*, builder, said he visited plaintiffs' works on Feb. 18, 1897. He carefully examined the signs of damage visible, but thought there was no sign of recent subsidence. The old cracks were quite distinct from the new. He considered the seven tie-rods in the red-lead works were to support the machinery, and not the building.

Mr. MANISTY, for the defence, then submitted that there was no case on the question of negligence. His learned friend rested his case simply on the fact that there had been an explosion caused by gas getting into the drains. But that was not enough; the mere fact of an explosion occurring was no evidence of negligence. No evidence had been called as to the state of the pipes; nor as to any notice having been given to the Gas Company.

Justice RIDLEY pointed out that there was evidence that there had been smells of gas for some time.

Mr. MANISTY (continuing) said that evidence must be given to show that the escape of gas was due to negligence. The point was whether the gas got out of the main and into the water-closet by some negligence on the part of the defendants.

Justice RIDLEY said the only evidence was that of the plaintiffs' plumber, who stated that the 3-inch pipe, where exposed, was rotted and decayed; and there was evidence that smells had been noticed for some time. He was quite surprised that plaintiffs' case had been left where it was. To his mind, the point was whether the explosion occurred because the defendants did not repair or keep in repair the pipes, or whether from some cause or other the pipe broke. If the Jury thought that the pipes broke on account of a slip in the land, the defendants would not be liable; but if they believed the pipes had been neglected, the Company would be liable. The evidence upon this point was that which he had already indicated—that there had been smells—and that the pipes were decayed and rotted away.

Mr. STRACHAN said there was evidence that defendants were continually mending the pipes in Shot Factory Lane and Skinnerburn Road.

Justice RIDLEY said that was in favour of the defendants; it showed that they were looking after them.

Mr. MANISTY, addressing the Jury, said the question they had to determine was whether the explosion was due to the negligence of the defendants. Undoubtedly, in arriving at a conclusion, they would consider what cause brought about the leakage. It was not for him to prove an affirmative cause, but for his friend to prove that the defendants had been negligent. With regard to the 24-inch main, the point at which there had been a pulling of the pipes was first of all near where the 3-inch main down Shot Factory Lane joined the 24-inch one in Skinnerburn Road. The main itself was perfectly sound, and the cement was good; but there had been a dragging. If his evidence was true, it was not a case of the cement having decayed or the pipe corroded through age, but the parting of junctions. What caused this parting? They had had no evidence laid before them as to its condition when laid bare; but he would call the persons who laid it bare, and they would tell the Jury that beneath the large main where the parting had taken place there were large cavities. There had been a falling away of the soil on which the main rested; and the result was that there was a movement of the main. This would cause the cement to crack, and make a parting of the joints. That being so, what caused the cavities beneath the main, if not a movement of the soil? He thought that they would come to the conclusion that the defendants were not responsible for such a movement. It seemed to him that before they could find the Gas Company liable they would have to decide that there was some defect in the pipes, in the way the junction was made, or that there was something to indicate to the minds of the Company that they should bare the joint. The Company could not possibly be going about over their 400 miles of pipes, baring them on the off-chance that something might be wrong. They took precautions to ascertain if the pipes were in good working order, by instructing their men to report whenever they found a smell of gas; and they offered rewards to persons who gave information as to escapes. In the present case, no information had been given that there was an escape. Therefore was the responsibility of an accident like this to be placed upon the Company simply because of the fact that there had been some movement of the soil, which caused the junctions of their mains to part, and consequently the gas to escape? The liability did not come upon the Gas Company unless negligence on their part was proved. There was no evidence as to negligence, except the witness who said that the 3-inch pipe was corroded, which the defendants denied. Witnesses would be called who bared the pipe; and they would say that but for the cracks, it was in good condition. Both the cracks in the 3-inch pipe and the parting of the joints of the 24-inch one were due to a "draw" of the land. If the Jury were satisfied that there was this "draw," then it was a thing over which the Company had no control.

Mr. *W. Doig Gibb* said he was Engineer to the Gas Company, and had

charge of the distribution system. The Company had 435 miles of mains. The lamplighters traversed the streets twice a day; and it was their duty to report all escapes of gas that they found, whether on services or mains. It was the duty of the other workmen to do the same. The police also reported escapes—to the Company's office during the day, and at night to a pipe-repairer named M'Cormack, who lived in one of the houses of the Company, and whose address was kept at the police stations. Further, the public were rewarded for reporting escapes. Within an hour and a half of notice being received of the escape, there was a gang of men on the spot. After the explosion, he had seen pieces of the 3-inch pipe that had been taken out; and it was absolutely untrue that it was decayed and rotted—it was in very good order. At the time of the explosion, he could not tell what caused the breaks in the pipes; but since then, after making careful examinations, he had no doubt whatever that there had been subsidence towards the river going on about the time of the explosion. This certainly was the most natural cause of the breakage. It had been suggested that the Company were laying a new main to replace the 24-inch one in Skinnerburn Road. They were laying a new main there; but when completed, both the old and new pipes would be used. He had made an inspection of the buildings alleged to have been damaged, and found a great many cracks, all aged. In his opinion, the cause of the breakage was that the land was slipping towards the river. It had been suggested that the gas went along the drains from the cottages to the other part of the works; but the drains had not been in any way damaged. Since he had seen a plan of the drains, he was further convinced the gas had not travelled along them.

In cross-examination, witness said the Elswick Gas-Works, which were near the plaintiffs' works, did not show any signs of subsidence about the date of the explosion. The life of a gas-main depended a great deal upon the soil; in a good clay soil, it would last for a hundred years. The 24-inch main had been laid forty years; and pipes taken out after being in the ground for this period were sometimes found to be thicker than those being laid at the present day.

P. M'Cormack, one of the defendants' workmen, said he bared part of the Skinnerburn Road main, and found escapes from two of the joints. There were cavities under the pipe large enough for a man to go underneath; and therefore the support to the pipe was gone. The main itself was in good condition.

In cross-examination, witness said he had not seen many joints cemented—lead was generally used. The cavities were about a yard broad, extending half a yard on either side of the joint; and they were about 2 feet deep under the pipe. He found similar holes about other joints. He remembered the coversation with plaintiffs' plumber. It was not about the pipes, but about the damage to the property. The plumber showed him the cracks; and after going so far, he objected to go further, because, as he said to the plumber, they were old cracks. He had been in the employ of the Gas Company for forty years.

C. Curry, another of the defendants' workmen, said he was one of the men who laid bare the 3-inch pipe in Shot Factory Lane after the explosion. He found the pipe, which was of cast iron, broken in two places. They cut the broken piece out, and put in a new one. It was not true that the piece taken out was decayed and rotted.

J. Beveridge, defendants' outside foreman, corroborated the evidence of M'Cormack as to the soundness of the Skinnerburn main, and as to the cavities underneath same.

Cross-examined, he said that when making joints they had to dig right round the joint; and when not properly filled in, the soil was liable to give way.

J. Routledge corroborated the evidence of Curry.

Dr. *Stevenson Macadam*, of Edinburgh, was called, and proceeded to show the impossibility of the explosive force travelling from the cottages to the buildings a considerable distance away; but on the objection of Mr. Strachan this was withdrawn, as was his evidence upon the extent of the damage done.

Mr. *J. Potts*, architect and surveyor, gave evidence as to the signs of subsidence about the district. He was of opinion that the cavities under the main were caused by the water from the river getting in at the quay wall and washing away the soil.

Mr. *D. N. Brims*, contractor, said that in the district in question there was a decided creep towards the river, on account of the dredging. He had noticed the cracks in plaintiffs' retaining wall increasing; and they were still developing.

Mr. *J. Holliday*, Engineer to the Scarborough Gas Company, said that a pipe laid in clayey soil ought not to suffer in twenty years, under ordinary circumstances. He had taken some pipes out at Scarborough which had been in use since 1837, and they were in fair condition. The average life of a gas-main was 35 to 40 years.

Mr. *Gibb*, re-called, said the 3-inch pipe in Shot Factory Lane was laid in December, 1876. The soil was of a sandy clay loam, and such as would tend rather to preserve cast-iron pipes than rot them.

Mr. MANISTY said that his learned friend, in opening his case, appeared to indicate that because there had been an escape of gas which caused an explosion, the Gas Company were liable; and not until it was pointed out to him that he must show negligence on the part of the Company, did he begin to base his case on negligence. They were all familiar with these actions for damages due to escapes of gas; and they knew that negligence must be shown before there was any liability. Ordinary cases of negligence arose from laying a pipe too near the surface, and heavy traffic causing it to break; from putting in improper material; or from a pipe having been in use so many years that the gas company ought to know it would be in an unfit condition for carrying gas. Nothing of this kind had been shown; and the only evidence was that of a witness who said the 3-inch pipes were corroded. The first question to consider was with regard to the 3-inch pipe in Shot Factory Lane—whether or no the two admitted cracks in the pipe were caused through any negligence on the part of the defendants, and whether they ought to have been known to them, or they had such information or indication as would lead them to suppose there was something wrong with them. His learned friend would probably say there was some indication, because there was a smell of gas; but the Company did not know this. Nobody thought it of sufficient importance to make a complaint. Then why were the defendants to suppose that there was a breakage in the pipe? They had it in evidence that there was nothing in the soil to cause the pipe to corrode, and that the pipe was not too old. Therefore what was there to lead the Company to go to the expense of lifting the road in Shot Factory Lane, to ascertain if there was any crack? When it was considered that they had 400 miles of mains, were they to be going about digging up the roads just on the off-chance of finding something wrong? It was unreasonable to suppose so. The Company must have some indication that there was something wrong, before it was necessary for them to bare a pipe. What was there prior to Dec. 5, 1896, to cause any reasonable man to take up the road to ascertain if the pipe was all right? It did not follow that, because it was found after the explosion there were two cracks in the pipe, there had been negligence. His Lordship, he thought, would allow that, to prove negligence, the defendants must have had reason to come to a conclusion that they ought to lay bare the pipe. He could not in the evidence see one thing to cause the defendants to go to the expense of taking up the road; and he would anxiously wait to hear what his learned friend would be able to point to as negligence. As to the 24-inch pipe in Skinnerburn Road, his learned friend would probably say the joints ought not to have been cemented, because if there is any movement of the soil the cement broke. He had yet to learn that the effects of jointing with cement and lead would have been different. The cemented joints had done their work, and were still doing it. There was no suggestion that the people in the works smelt gas, or that the people walking up and down the road noticed there was something wrong with the main. Without there was something to indicate to the defendants that they should bare the pipes, they could not be liable; and the law had most wisely said that a body occupying the position of the Company were protected unless they were proved to have been negligent. He contended that there was nothing to indicate that the main was not doing its work properly; and therefore the defendants could not be liable. The Company had not left undone anything which a reasonable man would have done.

Mr. STRACHAN submitted that he had shown absolute negligence. The defendants had the knowledge that there was an escape—or they had means of getting the knowledge, which they should have availed themselves of—and had neglected to take the precautions to prevent it. There was an escape in Skinnerburn Road which had been going on for years; and there was one going on that day which had existed for a considerable time. The defendants ought to have known of this—other people did. He then quoted from Michael & Will "On the Law Relating to Gas, Water, and Electric Lighting," the case of *Mose v. Hastings and St. Leonards Gas Company*, that "gas companies are bound to keep up such a reasonable inspection of their mains and pipes as may enable them to detect when there is such an escape of gas, by fracture or imperfection of pipes, as may lead to danger of an explosion; and if an explosion take place from a fracture or defect which has existed for several days, during which time it has also been discoverable by reason of the smell of the escaped gas, and would have been discovered by proper inspection, that is evidence of negligence on the part of the Company; nor is it enough to relieve them from liability that upon notice of the escape they sent a workman to repair the defect, he arriving too late to do so." In this case, he submitted the smell had been noticed for years. The lamplighters must have known of it—everybody seemed to have known it. If the lamplighters did not report it, they neglected their duty. Mr. Gibb admitted the best way to tell if there was an escape of gas was by the smell. Mr. Rollo, the defendants' Outside Manager, on the 5th of December, said in his report that the men had found a 3-inch main-pipe broken in three (not two) "different places in Shot Factory Lane; and the gas had found its way into the drains in and around their [plaintiffs'] works." Either the lamplighters did report the escape, or they did not. If they did, then the Company did not put the matter right, and there was negligence; and if they did not, there was certainly negligence on the part of the servants of the Company. Mr. Rollo on the 10th of December reported: "The escape proceeds from the 24-inch main (Skinnerburn Road), and also from a 3-inch main leading up Walkers, Parkers, and Co.'s Bank." The defendants suggested that the leaks were caused by subsidence; but he contended that this did not relieve them, because the gas had been smelt for days, and they ought to have known of the escape if they had kept up a reasonable inspection. Where were the escapes? Along Shot Factory Lane, there were at least two points; and it was shown by the plan that the drain-pipe from the cottages crossed the Skinnerburn 24-inch pipe just about the point where these two holes were found. The gas, having been fired in the cottages, ran along the pipes, causing a series of explosions. It was curious that, wherever the defendants had found holes, there was a joint. The foreman said that, when they were making joints in pipes, they had to dig round them; and if the soil was not put properly in, it was liable to give way. The cavities were at the very places where they would dig to make the joints. If it was found that the cause of the escape was due to this, then it was real negligence. As to the conversation between M'Cormack and the plaintiffs' plumber, he asked them to believe the plumber when he told them that M'Cormack said they were always repairing the pipe. This was the greater reason that they should carefully inspect it, because they knew it had been laid forty years—the limit of the average life of a pipe. One witness said the pipe in Shot Factory Lane was decayed and rotted away. If the fractures were due to subsidence, how was it that the smaller service-pipes had not been smashed? If there was a subsidence, it was wonderful that only the mains had been damaged, and not one of the plaintiffs' own pipes inside the meter had been disturbed. If the defendants could have shown that at about the time of the explosion walls near the gas-works had been damaged, it would have been reasonable to suppose that there had been a subsidence. It could not be true; for, as a matter of fact, flags and concrete were thrown up, and this was inconsistent with subsidence, and could only be accounted for by an explosion. There was absolute negligence by the defendants in not discovering that there were escapes when other people could find them, and for allowing defective pipes to remain in the ground.

Justice RIDLEY, in summing up the case to the Jury, said that the Gas Company were not answerable for the explosion unless it was caused by their fault. It was not their duty to break up roads and bare their pipes to examine them, when they had no reasonable cause for doing so; it was only their duty to take reasonable care that such accidents should not occur. Therefore, the question they had to decide was whether the defect which caused the explosion was due to negligence on the part of the defendants. There was scarcely any evidence as to negligence to go on. He was surprised that plaintiffs' case stopped where it did. What was the negligence? It was said by one witness that he had seen some

of the 3-inch pipe, and it was decayed and rotted away. There was further evidence that smells of gas had been noticed before in Shot Factory Lane and Skinnerburn Road; and there was also evidence of former smells. The Jury saw the nature of the duties which the defendants had to perform, and how they might fail. They might fail by putting in bad material, by not laying the mains low enough and heavy traffic causing a breakage, by not laying them properly, by not jointing them efficiently, or by leaving the mains too long in the ground. In this case there was not a particle of evidence to justify a verdict against the defendants upon these points. Though one main had been in the ground forty years, and the other twenty, there was evidence that they were by no means worn out. There was evidence that there had been smells of gas; and ought defendants to have known and digged into the ground and remedied it? This, it seemed to him, was the only point which could be laid as negligence on the part of the defendants—viz., had they kept a reasonable watch over the mains and pipes, and ought they to have found out that there was an escape? He could not accept that, because they had not been given notice, they were relieved of liability. The question was, Did they keep a reasonable watch so as to enable them to find out when there was anything wrong with the pipes? In the present instance, there had been evidence that there was an escape for a considerable time; and it came to this—Was there such a state of things that a man passing along the road would notice the smell of gas? The defendants had their lamplighters and other workmen, who reported such things; and they also offered rewards. There was no complaint made to the defendants; and therefore were things in such a state as to enable the lamplighters or other workmen of the Company to find that there was an escape? Without this, it was unreasonable to think that the Company should pull up the street. It was admitted there was an explosion; but there is one thing he could not understand, and that was how it could affect buildings such a distance away. The only point for the Court to decide was whether or not the defendants were guilty of negligence. The defendants had stated that there was a slipping of the ground; and he thought they would agree that there had been subsidences. It had been stated by the plaintiffs; and Meston, plaintiff's plumber, gave evidence of importance as to a crack. He said that the crack in the retaining wall had been there a long time, but was getting wider. The contractor last called also said it was getting wider, and it appeared to him (Justice Ridley) that the bank was slipping as well; otherwise how was it that a brass coupling on pipes within the plaintiffs' gates was found to have been torn away so that the pipes were leaking? Plaintiffs were, therefore, actually repairing one of their own pipes which had parted from the joint. It could not be suggested that it was badly laid, or of improper material; but there was a pipe which had parted from its joint with the next pipe.

Mr. STRACHAN: He said that was due to the explosion.

Justice RIDLEY: No, no, he did not. Continuing, he said it was taken that the leak which caused the explosion was from the Shot Factory Lane pipe, and not from the Skinnerburn Road pipe. But in Shot Factory Lane what had caused the two or three breaks? These surely pointed to a slipping of the soil. It does not speak of bad material, or leaving them to be worn out, but that some change had taken place which had broken the pipe. When did this occur? Possibly it was some while before the explosion, because witnesses had stated that they smelt the escape some time before. The point was that the defendants would not be liable unless they failed in their duty. The only duty which they could be said to have failed in was in not noticing the escape sooner. The men who lived in the cottages knew of smells of gas; and one of them (Meston) complained to the Manager. But the Manager never communicated with the Gas Company. The point must be: Ought the Gas Company not to have found, by their agents passing to and fro in Shot Factory Lane, that there was a smell of gas? If they could have found it out by reasonable means, there would be a verdict for the plaintiffs. If it was not likely that a man passing to and fro could tell that there was an escape, then the defendants would be entitled to the verdict. With regard to the main in Skinnerburn Road, this seemed to bear less upon the question. What caused the cavities under the pipe might be a subject of inquiry. This pipe, however, was not, he thought, the cause of the explosion, though smells of gas had been found coming from it. It appeared that the explosion occurred because there were two cracks in the Shot Factory Lane pipe.

The Jury, after a few minutes' retirement, returned with a verdict for the defendants.

Justice RIDLEY thereupon gave judgment in accordance with the finding.

THE ASSESSMENT OF THE SOUTHAMPTON GAS-WORKS.

(*Before Mr.* E. U. BULLEN, *Recorder of Southampton.*)

Friday, March 11.

We continue to-day our report of the proceedings on the appeal of the Southampton Gas Company against the assessment of their property by the Southampton Guardians, which came before Mr. Bullen, as Arbitrator, at his chambers in London.

Mr. BALFOUR BROWNE, in opening the case on behalf of the Southampton Guardians, said that the Recorder would be mainly guided, not by any argument he could address to him, but by the evidence. Of course, as Mr. Marshall said, he was bound to make as much as he could of the tenant's capital; and he would show that the tenant's capital had been grossly inflated. In the working expenses and maintenance and repairs, they had got far too large a figure. If he succeeded on these two points, then the Recorder would have to rectify the calculations placed before him; and he would have to say they were justified in putting the rating of Mr. Castle in November, 1897. Mr. Ryde had made a statement that morning that it did not much matter whether they added the receipts from residuals to the gross receipts or dealt with them as against the coal. It mattered largely. If they took them as Mr. Marshall had done, they got the working expenses inflated. The right method was to adopt Mr. Ryde's principle. He took the cost of the coal, and put the receipts from residuals against it. This affected the important question of the amount of working capital to be allowed. There were two ways in which he might look at the amount for repairs and maintenance. They might take the actual figures or an average; but if they were to adopt actual figures, they must assure themselves that they fairly represented the amount that was spent from year to year. If, on the other hand, they took an average, it must be a fair one; and he thought, from the examination of Mr. Corbet Woodall, that Mr. Marshall arrived at an entirely erroneous conclusion of what was fair in this case. In Table B, he found that Mr. Marshall made an average for 1891-2-3-4-5 which came out at 4s. 7d.; but he ought to take, not only the high years, but the low ones as well. Did the Recorder see that, in order to get a high average, Mr. Marshall had excluded 1896 altogether? Mr. Littler and Mr. Corbet Woodall tried to escape this criticism by saying that in 1896 there were the new retorts, and therefore they were working more cheaply. This was the very reason why 1896 should be in. It was necessary to go further, and to see whether, as a fact, the years that had been chosen to find the average were fair ones or not. Mr. Littler seemed to suggest on the previous day, in re examining Mr. Corbet Woodall, that they could not take an average of other companies and apply it to this one. But Mr. Corbet Woodall had done this himself. He had taken the 6d. as a usual rule from his general experience, and applied it here. The criticism that they must not take averages therefore fell to the ground. The Provincial Companies to some extent differed; but when they took a large average, it certainly eliminated the difference. What cost the Southampton Company 4s. 11d. in 1891, cost the Provincial Companies 3s. 6d.; in 1892, 5s. and 3s. 4d.; in 1893, 4s. 8d. and 3s. 4d.; in 1894, 4s. 1d. and 3s. 7d.; and in 1895, 4s. 7d. and 3s. 7½d. When they came to 1896, they found that the Southampton Company were not doing their duty. In other years, they had been extravagant in the cost per ton of coal carbonized. In 1896, the average of Provincial Companies worked out at 3s. 8d., against 3s. 10d. for the Southampton Company. The best thing they could go upon in this case was the average of the other companies, when they found that it was so accurately confirmed by the working in 1896. In 1890, the matter began to be important. In former years the Company had been earning more than they could divide; and they laid away large sums of money upon which they had to draw for their dividend in 1890. No one could say the works were not properly maintained; they were kept up for the 3s. 10d. Taking the figures founded upon their working for 1896, they could be substantiated by gentlemen experienced in other places; and they agreed they could reduce the 3s. 10d. It was a remarkable fact that Mr. Marshall should have been employed in 1891 on the other side, and have made the rateable value higher than it was that day, although there had been £50,000 spent on the hereditament since. The excuse was that the hereditament had increased by that extent, but there was consequently more to repair. That was absurd. If Mr. Marshall was right in 1891, something higher must be the rateable value to-day. After referring to the items for repair and maintenance, the learned Counsel dealt with tenant's capital, and said they had inflation of various matters. The Company's case was based on five months' working expenses, although in London the Companies were only allowed 4½ months. Why one company should be able to do with 4½ months, and another wanted five, he could not see. The time the appellants allowed to get in their money was too long; and it must be remembered they got long credit for coal and salaries. The Guardians had allowed 4½ months for the whole of the working expenses; and he thought the Recorder would come to the conclusion that here in London it was perfectly sufficient. Then meters and stoves, and things of that sort, were added; and instead of arriving at a true value, they had been depreciated far too little. Then they asked to have eight weeks' coal. The Recorder would find that this was eight weeks' coal in addition to the five months' coal they had in the working expenses. If they took five-twelfths of the working expenses, they had five-twelfths of the coal for the year; and the Company got cash for seven months' coal out of the twelve. This was inflation. Mr. Ryde said six weeks' coal was sufficient for The Gaslight and Coke Company; but here he wanted eight weeks'. Again, he claimed half the stores shown in the balance sheet as tenant's stores. This had been allowed for in the tools, implements, and furniture; while the principal store—coal—had also been allowed for. As to the plans, ledgers, and meter-books, the whole of them were the landlord's. The suggestion was that the tenant was to get 17½ per cent. on the £1250 for the plans. Supposing it was necessary to have the plans, was the tenant to receive 10 per cent. for profit, 5 per cent. for interest, and 2½ per cent. for risk on them? What were the risks to the plans? The matter was too ridiculous to be argued. No tenant would expect 17½ per cent. on stores or on the £2500 cash at the bank. Anything like £44,000 for tenant's capital could not be substantiated at all; and when the Recorder came to consider the capital, and the interest, profit, and risk, it was utterly absurd to take some of the items at 17½ per cent.

Mr. *W. A. M'Intosh Valon* said that he knew the undertaking of the Southampton Gas Company. The works were in very good order, and there was a margin for substantial increase. He did not notice any blighting effect of the electric lighting. The increase during the first half of 1897 was 17½ million cubic feet. When the prepayment system was adopted, the increase would be very large. The money came in as soon as the gas was sold.

The RECORDER: What is the cost of installing the system?

Witness: About £4 per house; but the price of gas is increased.

Examination continued: He had inspected the Company's accounts. The gross receipts were £66,623, excluding the rates. He had allowed for coals, purifying materials, salaries, repairs of meters, half Directors' fees, &c., £40,793. He allowed half the Directors' fees, because he divided them between the landlord and tenant, as the landlord's hereditament had to be looked after. All the extensions were done by the staff; but he had not halved them. He had disallowed repair and maintenance out of the working expenses, as well as repairs of mains and rates and taxes. He allowed them elsewhere.

Mr. BALFOUR BROWNE: Having deducted these sums from the working expenses, what do you find the net receipts?

Witness: £25,830; and I start with this to deal with tenant's capital. Four-and-a-half months of the working expenses comes to £15,297. Taking away the supplemental rentals, the consumers' deposits, and £5981 receipts for residuals, left £9316 for coals. I think 4½ months is quite sufficient to allow. Within six weeks the bulk of the rental will come in. On the other side, considerable credit is allowed for coal. Witness went

on to say that after having money for six months' rates, the tenant would have to handle £11,166, allowing sums for coke and breeze, and sundry other stores. On these he would give 10 per cent. He differed from Mr. Marshall as to the amount to be put down for depreciation of meters. The life of a meter was about 20 years. The meter was repaired three times in that period; and he put the depreciation at 33⅓ per cent. The present value of meters and stoves he put at £11,219. Seven or eight years was the utmost that could be allowed for a stove; 33⅓ per cent. depreciation would not be sufficient. He had allowed 12½ per cent. on the £11,219 for stoves and meters. There was no risk, and there was no reason why a heavy allowance should be made. For tools and implements he had put £2000, or 1s. per ton of coal carbonized. It was utterly unnecessary to keep a large store of tools; and companies did not do so now. The repair of the hereditament required the principal part of the tools. The total tenant's allowances was £4050; and the gross estimated rental, *plus* the rates, was £21,774. He took the repairs, maintenance, and renewal of the mains, &c., at 4½d. per 1000 cubic feet—£3708. The net rateable value was £11,367; the Corporation being entitled to rate the Company at £9383.

Cross-examined by Mr. LITTLER: He was not in the first instance consulted in the making of the rate. He made his valuation about two months ago, after he had been over the works. He did not see the difference where they brought in and left out the item for residuals, provided there were the proper credits.

Mr. LITTLER: Do you know the Board of Trade charge for electric light?

Witness: No.

You say there is no serious competition?—I do not think I did say so, but I will do so.

Does not the question of serious competition depend upon whether people are strenuously pressing the electric light, and running it at a low price?—It is a factor; but we find that the consumption of gas increases with the use of electric light, which is dearer than gas.

Suppose it is supplied as cheaply as gas, do you mean to say that any man would adopt gas before electric light?—I would, for one.

Do you know whether there is any demand for "penny-in-the-slot" meters at Southampton?—I do not.

On the question of repairs and maintenance, what would you do yourself for your own Company in asking for relief of rates, if you found one year was lower than another? Would not you seek to average that?—Certainly; but averaging may be a good guide in one case and a false friend in another. This is not a sliding-scale Company; it is one with a maximum price and maximum dividend. From the Company's point of view, they spend quite as much money as they ought on repairs and renewals. The Company lay out the money judiciously; they are spending it on renewals.

If this is not a sliding-scale Company, you would not apply to it sliding-scale principles?—No; like principles ought not to apply to each.

You have told me a non-sliding scale company are justified in doing certain things?—It does not affect this Company, and it would affect a sliding-scale company.

Do you say the Company have done anything which a sliding-scale company ought to have done?—Not from their point of view; I cannot point to anything.

Do you know of any renewals done in the years 1891 to 1895 except on retorts and arches?—I have no accounts except those for 1896.

Dealing, in further cross-examination, with the subject of tenant's capital, witness said the tenant would require to have 4½ average months of total expenses. If a tenant came in at Michaelmas, he would come in at the heaviest time. He would get the supplemental rental. He could not say how many tons of coal were carbonized in October, November, December, and January last; but he presumed the figure of 19,000 tons given to him was correct.

Mr. LITTLER: Can you suggest any concern in the country where a person risking £66,000 would be content with £4056 out of it?

Witness: He would be manager as well, and I should think he would be quite satisfied.

Mr. *A. Smith*, a consulting engineer and valuer of Birmingham, examined by Mr. BARNES, said he had valued the undertaking of the Company from the 1896 accounts. He took the gross receipts, including the sale of fittings and excluding residuals, at £55,502; and the working expenditure was £30,368—leaving a balance of £25,134. He allowed 4½ months' working capital, which was the usual thing.

Cross-examined by Mr. LITTLER: In rating cases for gas companies, he had never applied a principle of different interest for different items; but whenever he acted for companies he always put down 17½ per cent. all round.

Mr. *F. W. Pixley* was questioned in regard to the average interest paid on various capitals.

Mr. LITTLER objected to this.

The RECORDER upheld the objection; and the examination of the witness was not proceeded with.

Mr. *H. J. Castle* stated that he had followed the accounts of the Company for the year 1896 in this case, and had found the rateable value of the works to be £12,180.

Mr. BALFOUR BROWNE: Do you think the rateable value you have advised and put into the assessment list is fair?

Witness: It is a moderate one, in my opinion.

Cross-examined by Mr. LITTLER: He made his valuation on the 29th of August last, and had complete access to the works. He did not make an inventory of the tools; but he made a schedule of the fixed plant. He regarded the gantry and engines upon it as fixed plant.

Mr. LITTLER: You regard that which travels on a road as equal to the road itself?

Witness: I do. It was not very material to see the tools before I valued them. I did not see what stock of coals they had; and I did not ask if the price of gas had gone down during the past few years. I do not think this material, because it was all represented in the receipts. The insurance ought to have been included in my list; but it was not. I deliberately left out the Directors' fees.

Did you forget that all the residuals were not sold for cash?—It may be so. I have not allowed for lamp-fittings, meter-fittings, or any part of the sundry stores.

Re-examined by Mr. BALFOUR BROWNE: He relied on the alternative valuation as a test method.

Saturday, March 12.

On the resumption of the proceedings this morning,

Mr. BALFOUR BROWNE said he had come to the conclusion that he could not throw any further light on the case by putting forward evidence. He therefore would not call Mr. Beddoe. He had very few remarks to make on the case. He gathered from his friend's long and painstaking cross-examination of Mr. Valon, that he raised a point with regard to the expenditure upon repairs, maintenance, and renewals. The question for the Recorder was whether he would take the actual figures of the Company in a particular year, or whether he would adopt what he ventured to call the doctored figures of Mr. Marshall. In a particular year, it worked out at 3s. 10d. per ton of coal carbonized—a little less than 4½d. per 1000 cubic feet. The respondents had allowed this; and they said it was enough. They proved this, not only by the fact that the Company did it, but by an average of Provincial and other Companies who were able to work at very much lower figures than the Southampton Company; and therefore it was entirely erroneous to say that these years were abnormal ones. The respondents said the Company must be tried by their own success. Their success, in 1896, was to manage, repair, and maintain their own works at 4½d. per 1000 cubic feet of gas sold. The next point made by the Company was that, 4½ months of the full expenses for working capital, was not allowing enough. He could not really follow his learned friends on the point. The position was this: They had allowed 4½ months' expenditure in hand, which amounted to the large sum of £15,297. It would provide them with 4½ average months of coal. But beyond this they had allowed 1½ months of coal (£2746) as a stock in hand. Thus they had got six average months' coal; and would not this amount carry them through 4½ months in winter? He asked the Recorder to say that sufficient coal had been provided for the tenant. The next point made by Mr. Littler was, What was coming in to the tenant during the 4½ months? If nothing came in, they had allowed 17½ per cent. on £16,000; and they had from Mr. Marshall the figures of £669 for prepayment rentals, and £538 for consumers' deposits. So there was over £1100 coming in. The residuals amounted to £12,730 in the year; and even if one-third of the sum did not come in, a very considerable part of it would. What would be going out? Barring wages, there would be practically little more than the coal account once a month. They were getting credit for the coal. Besides this, rates and taxes would not be paid until the end of the half year. This was allowed for by £1800 in the Guardians' figures, which sum would be in hand for a tenant to use as floating capital. It was said by Counsel on the other side that the rental upon 4½ months was not enough for the tenant's capital; and he ventured upon a theory that a tenant should have money for rent. But none of the witnesses had said that he should.

Mr. LITTLER: Mr. Marshall said so.

Mr. BALFOUR BROWNE remarked that it was not in Mr. Marshall's tables. This meant they were to have the rent and 17½ per cent. upon it; and they were reducing the landlord's rent by 17½ per cent. The thing was ridiculous. Mr. Littler had talked about tea and treacle. In tea and treacle there were tenant's risks, for if a tenant had a large stock of tea the price might change. On the other hand, fixtures would be useful. Suppose the Company went bankrupt, said his learned friend, and they had to sell at a breaking-up value, where would they dispose of the coal? He (Mr. Balfour Browne) did not know of any rating principle which dealt with that view.

The RECORDER: No; I treat it as a going concern.

Mr. BALFOUR BROWNE next dwelt on the suggestion of Mr. Littler that no one would be satisfied with £4056 on a turnover of more than £56,000. He thought it was an excellent return. Thus a tenant with a capital of under £20,000 the Guardians said, or £40,000 as stated by the apellants, would have £4000 a year. There was the landlord with £215,000; and he was to have a rental for the whole undertaking of £6000. He would rather be the tenant than the landlord. The next matter was the question of the tools. Mr. Littler was anxious to know if Mr. Castle had valued the tools. It was impossible to do so unless the concern was stopped. All he could do was to arrive at an approximation of the value. Most gas companies would have about the same number of tools relatively to a ton of coal carbonized; and it worked out in this case to about £2000. Mr. Valon had gone through the inventory prepared for the Company; and he had arrived at £1788 as the figure. In the £2000, they had allowed 1s. per ton of coal. He (Mr. Balfour Browne) said he knew the experience the Recorder had in rating matters; and he would not refer at all to how the cranes in St. Katharine's Dock had been dealt with, because it was only done in Quarter Sessions in London. The cranes at Southampton ran a few yards; but the whole gantry and the cranes on it were one instrument. They were intended to be used only in one particular place, and were one instrument just as a steam-hammer was. The principle the Courts had laid down was that if an article was intended to remain permanently during the time that it was used for the gas-works, it was to be treated as enhancing the hereditament. If not, it was not to be so treated. This gantry, on which the cranes were, was intended to be used for the unloading of coal; and the movement of the cranes was merely to get to the different holds of ships. There was one thing Mr. Castle was wrong in. He ought to have included £300 for insurance; and some things in a list which he disallowed, were clearly tenant's—such as oxide of iron and lime intended for the purification of gas. These should have been allowed for; but it amounted to very little, as the total figures for tenant's capital came out at £18,070. Mr. Castle, however, had allowed £20,000, which would cover everything which should have been included.

The RECORDER: There is one thing you have omitted, and that is the Directors' fees.

Mr. BALFOUR BROWNE admitted that this was to some extent wrong. He preferred going upon principle, rather than mere elimination. He thought Directors' fees ought to be allowed—this was decided in the Queen's Bench Division; but at the same time, he did ask that all Directors' fees should not be allowable. There were some of these fees paid for locking after the landlord's business. The Recorder would come to the conclusion, he thought, that a portion of the Directors' fees should be allowed, but not the whole. The only other point was a very striking commentary on Mr. Marshall's figures. When he came to apportion, he did not do so in the usual way, by a percentage upon the capital value; and he would show why. If Mr. Marshall did put a percentage on the

capital value, he would leave nothing at all for the total value of the mains, which he put at £87,400. This was a startling thing; there was nothing left for the rateable value of £87,400. Remember what Mr. Marshall was doing. He had valued outside the borough, not for the Company, but for the Rating Authorities; and the rateable value of the mains outside the borough was £1967. If he tried percentages on the values he had got there, he would have absolutely nothing against it. So he made a rule-of-three sum, to avoid the difficulty of £3473 for the works; and then, to get at the gross, he added £4742. No one had seen a difference between gross and rateable value of 136 per cent. Then he was landed in another fearful absurdity. By thus treating the works, he got a rateable value of £2554 for the mains, instead of nothing upon the percentage system. The mains outside the borough were rated at £1967. He took this from his figure of £2554; and it left £587 as the total value, according to Mr. Marshall, of the whole of the mains in Southampton. Well, they had agreed that 66 per cent. of the mains were within Southampton, and the balance outside the borough. Where Mr. Marshall was now, he did not know. It showed that Mr. Marshall was driven to the rule-of-three value, because he found, by the principle of percentage, there was nothing left for the mains at all.

Mr. Littler, replying on the whole case for the Company, remarked that he was bound to say if there ever was an instance which justified an application for a reduction of the assessment, it was this one. He had never heard a case put before an Arbitrator on such extraordinary grounds as those for the Guardians. Let them go to the main circumstances and facts, and see how the matter stood. He was sorry that Mr. Balfour Browne had not that morning called Mr. Beddoe before the Recorder, for more reasons than one. The Recorder had to be guided by the facts of the case in deciding what money a tenant would give for any particular hereditament. When it was a trading concern, they had to find out what the tenant was likely to give having regard to what was the probability of the continuance and success of the business going to be carried on. There was the strongest possible evidence that injury had been done to the Gas Company at Southampton in far more than ordinary proportion, by the electric light being in the hands of the Corporation, who were running the concern at prices which must be a loss to them. That was a thing which everybody on the other side entirely ignored; but it was an important factor. The Recorder had heard what had been said with regard to it. He did not think in London itself they could find so many shops of any importance in the main streets lighted by electricity as was the case in Southampton. The shopkeepers had a direct interest in the electric light as ratepayers; and they obtained the necessary current at a very cheap rate. The Gas Company at Southampton had not got a monopoly. The other side had utterly ignored this, as well as every principle of common sense. Though the Company at the present time charged 2s. 11d. per 1000 cubic feet for gas, when the electric light came in they had to reduce the price to 2s. 6d., in order to support themselves in their dividend. The Directors were not only keeping as large a reserve fund as possible, but they had also held undivided balances. The Company had very large undivided balances, which had not been attributed to anything; and the Recorder would remember what Mr. Smith, the Secretary of the Company, said about the sums which had been taken from the balances to pay the dividends. They had come to the end of them, and they had to take something from the reserve fund. This was the time when the Guardians had chosen to increase their rating. There was nothing more disagreeable for a gas company than to come into antagonism with the ratepayers. Absolutely the Company were asked to be rated on this enormous sum, and to pay rates to their competitors, the Corporation. They were driving down the price of gas, forcing the Company to part with money which not only had been earned, but had already been rated. The actual sum paid in rates to the town of Southampton in 1896 was £2500; and the profit of the Company was £15,000. Therefore the rates were about one-fifth of the money they had to divide. This rating meant 3¾d. on every 1000 cubic feet of gas. In "Field's Analysis" for 1896, the rates and taxes of The Gaslight and Coke Company, notwithstanding that the average was enormously increased by the heavy rates imposed by the Quarter Sessions at Clerkenwell, were 2·63d. per 1000 cubic feet; of the Commercial Gas Company, 1·62d.; and of the South Metropolitan Gas Company, 1·68d. This gave an average of about 2·30d. for the London Companies. If they looked through the whole of the Suburban Companies, there was only one which gave 3·30d., and that was the Lea Bridge Company, which had the misfortune to supply West Ham, where the rates were 12s. in the pound. The average for the Suburban Companies was 2·13d. If they looked at the Corporations, they would find that none of them, except Salford, which had had to bear the result arising from the enormous frauds which had been perpetrated on them, came up to Southampton. Nottingham came out at 1·64d.; and Manchester at 1·62d. The average was 1·47d., or less than half of what was asked from the Southampton Gas Company. When they looked at the Provincial Gas Companies, they found a most striking contrast with Southampton. Sheffield stood at 2·04d.; Derby, at 1·60d.; Bath, at 1·34d.; Brighton, at 1·32d.; Bristol, at 1·24d.; Liverpool, at 1·30d.; Newcastle, at 1·29d.; and Rochester, at 1·06d. Of the South-Coast towns, Brighton was 1_3d. and Plymouth was ⅔d.; and yet the Southampton Company were asked to pay 3¼d. Then there was another consideration. Everybody knew that public companies were compelled to publish their accounts, and so on; and being more or less rated on profits, they were rated out of all proportion to the amount levied on other persons within the limits. Perforce they were rated contrary to the Act of Elizabeth. Now, let them see whether Mr. Marshall merited the criticism of his learned friend—that he left nothing for mains outside the borough. He had not done anything of the sort. He had taken the structural value; but the rating was not to proceed on that. He could deal with this point by citing the South Staffordshire case as an authority. It was reported in 16 Q.B.D.; and in that case Lord Esher said they ought not to consider the value of the whole works as they now existed, and that a percentage of 3 or less should be given on landlord's property. He (Mr. Littler) was not at all prepared to occupy the Recorder's time by discussing whether or not Mr. Marshall in 1893 did or did not adopt the same principle as he had now done.

The Recorder: I do not think it material, because the sole purpose of the suggestion made by the witness was for Mr. Balfour Browne's cross-examination.

Mr. Littler: I am desirous of pointing out that the principle which was adopted in 1893 and now was the right one.

The Recorder: Whether Mr. Marshall went right or wrong in 1893 does not assist me in the least.

Mr. Littler remarked that in 1893 the price of gas at Southampton was 2s. 11½d. per 1000 cubic feet, as against 2s. 7½d. in 1896.

The Recorder: I have had all that. I do not want to go all through it again.

Mr. Littler said the actual profit earned in 1892 was £14,604; and the statutory interest demanded £16,848. The coal carbonized was 30,209 tons. In 1896, it was 37,939 tons; and although one-fifth more coal was carbonized, the actual profits were only £1300 more. The rateable value of the whole place in 1893 was £8498, as against £10,264 in 1896, when 50 per cent. of the buildings and works which required maintenance were useless.

Mr. Balfour Browne: There is no evidence that they are useless.

Mr. Littler replied that they were 50 per cent. beyond the capacity. Everyone understood the rateable value of that must go down, because the maintenance was enormously larger. The allowance given by the Guardians for the maintenance of the mouthpieces was £20; whereas the Company only put it down at £18. If the Recorder paid the slightest regard to the South Staffordshire decision, it was absolutely essential that he should take the maintenance into consideration. He could quite understand why Mr. Balfour Browne did not call Mr. Beddoe, for his valuation brought out the working expenses at £46,000. The Company had taken into account the working expenses of a series of years. His learned friend said they had left out 1896; and he condemned the working expenses of Mr. Marshall as he said he had only taken averages for five years.

Mr. Balfour Browne said the £46,000 of Mr. Beddoe did not compare with Mr. Marshall's valuation at all, because in it he had got all the statutables.

Mr. Littler reminded the Recorder that in Mr. Beddoe's No. 2 valuation, he took five months' working expenses, and six weeks' stock of coal in addition. The Company claimed five months; and one of the witnesses of the Guardians agreed to it.

The Recorder said a good many of Mr. Beddoe's figures were worked out wrong. The item for cash at bankers was not what they had had proved.

Mr. Littler: It is a very odd thing that this gentleman comes out at a rateable value very much the same as the others.

The Recorder: I cannot understand it.

Mr. Littler: I can. There was an order went out that Mr. Castle was to be supported, and this gentleman supported him. It is a most marvellous document; and I do not at all wonder that Mr. Beddoe was not called. He allows nothing for rates in the tenant's capital. He is out more than £5000 in his allowance there; and he allows 17½ per cent. on the whole. The same result arises from the second as from the first valuation. In the first valuation, Mr. Beddoe allows 17½ per cent. on the working expenses; but on the half-year's rates and taxes he only allows 7½ per cent., and a like amount on stores. He takes three months' working expenses; and yet he arrives at £15,204. The learned Counsel then proceeded to criticize Mr. Valon's valuation. This gentleman allowed one-sixth for tenant's repairs. Some other witnesses allowed one-third; but in one of Mr. Beddoe's valuations, he took in the whole. So did Mr. Castle; and yet they arrived at the same result. He (Mr. Littler) claimed to add one-sixth to Mr. Valon's valuation, so as to make the thing comparable. Mr. Valon left out £500 of the Directors' fees, and put the law charges at the very low figure of £15, when the parties agreed on £150 as fair.

The Recorder remarked that if there were many rating appeals, that figure would not be high enough.

Mr. Littler quite agreed. There was thus an omission in Mr. Valon's estimate of £1853; and if this sum was put to the £40,793 he allowed, it made £42,646 for his expenditure. This was within £3000 of what the Company got to. That was not all. If they took the allowance of Mr. Valon for tenant's capital for 4½ months, the £40,793 should be £42,646; and three-eighths of this made £15,992, instead of £15,297. Mr. Valon allowed 17½ per cent. for working expenses, which contained the whole coal for six months; but when he came to coal in store, six weeks', he only allowed 10 per cent. Why? It was equally necessary to have the margin as to have that which was in use. There, again, he was ridiculously wrong. He only allowed 10 per cent. on tar, breeze, coke, and sulphate. Counsel characterized the division of percentage as idle nonsense. A correction of the Guardians' own figures showed the gross rateable value as £10,355, instead of £11,472. How was the Recorder to be guided by these figures? Mr. Valon had not got any sinking fund. Mr. Balfour Browne had said that the Company ought to have included the cheap year 1896; but if they did, it only brought down the average price of coal carbonized from 4s. 7⅜d. to 4s. 6¾d. per ton. After citing the cases of *Regina v. The Cambridge Gas Light Company* and the Brighton case, in 15 Q.B.D., p. 356, Counsel laid stress on the evidence given for the Guardians by Mr. Smith, of Birmingham, who said he had never in his life allowed less than 17½ per cent. on tenant's capital all round. Was there any reliability to be placed on witnesses who came there with such differences; was there ever such juggling with figures in this world? Mr. Valon disallowed £77 10s. 6d. for the things in the drawing office; but every gas company must have a drawing office. Tools in the yard fitter's shop and smith's shops he also saw fit to disallow.

Mr. Barnes said Mr. Valon disallowed everything required to repair the hereditament.

Mr. Littler replied that for one repair required for the landlord, there were a thousand for the tenant. Incidentally, the learned Counsel stated that he hoped the Recorder would go and see the works before he gave his award, and especially should he see the gantry, which was a labour-saving appliance. With regard to the Directors' fees, he thought £1000 was a reasonable allowance in a case of this kind. He had now gone through all the items; and he asked the Recorder to come to the conclusion that the Company had for a very long time previously been overrated. That he would not regard unfavourably; they submitted as long as they could, and avoided the enormous expense which was inevitable when a rating appeal took place. He asked that the Company should be awarded the fullest possible costs.

The Recorder requested a copy of the correspondence. This was handed to him; and

Mr. Littler reminded the Recorder that the Guardians declined to see or hear the Company in reference to the increased assessment of their works.

The proceedings then terminated; and Mr. Bullen took time to consider his award.

Securing a Supply of Gas by Means of Tin Discs.

Fred Finney, a bricklayers' labourer, was furnished by the Wath Gas Company with a prepayment meter on Aug. 24 last; and when it was examined later, it was found to contain 3s. 3d. The meter was next inspected on Feb. 10, when it was discovered that it had been broken open. The dials indicated that 3206 cubic feet of gas had been consumed, the charge for which was 13s. 4d.; but only a penny and seven pieces of tin of the size of coins were found in the box. When brought before the Rotherham West Riding Magistrates last week, Finney pleaded that he was innocent; but he remembered that his wife, who had been ill fourteen months, had told him that she had put the tin discs in. However, the Magistrate saw fit to impose a fine of 10s. and costs, or fourteen days' imprisonment.

Dispute as to an Oil-Engine.

In the Queen's Bench Division of the High Court of Justice, on the 11th inst., Mr. Justice Bigham had before him cross-actions in regard to an oil-engine. The first was brought by Mr. Joseph Day to recover instalments of royalties on a patent for an oil-engine, due under a licence from him to the Millbay Engineering Company. The defendants alleged that the plaintiff was not really entitled to these payments, but that the Valveless Gas-Engine Syndicate were the persons so entitled by reason of a prior agreement affecting improvements on the patent for a gas-engine. They, therefore, gave notice to the Millbay Engineering Company not to pay the plaintiff the royalties which they (the Millbay Company) did not deny were due to somebody. The question, therefore, was whether the patent for the oil-engine was really an improvement on the gas-engine owned under the agreement by the Valveless Gas-Engine Syndicate or a separate patent not included therein. It was stated, in the course of the arguments for the defendants, that the clause in the agreement as to improvements had been put in conveyances of letters patent for more than twenty years; but, curiously enough, there was no precedent where a definition had been given of the term "improvement" of an invention. For the defendants' contention evidence was given by Sir F. Bramwell and others. His Lordship decided that Mr. Day's later invention was not an improvement on his gas-engine patent; therefore there would be judgment for him against the Millbay Company for the amount admitted to be due (£200) and costs. In the second action, which was brought by the Valveless Gas-Engine Syndicate, Limited, against Mr. Day, his Lordship gave judgment for the defendant, with costs.

Penny-in-the-Slot Meters in the United States.—An interviewer from the Columbus (Ohio) "Despatch" has elicited from Mr. Irvin Butterworth, the Superintendent of the Columbus Gas Company, the statement that the demand for penny-in-the-slot meters has astonished him. Two-thirds of the private houses in the city have hitherto been supplied with oil; but the tenants are now bringing their patronage to the Gas Company because of the adoption of these meters, which are being made in the States under licence from "Meters, Limited"—the Company promoted in England last year.

Leeds Gas Committee and Union Workmen.—At a meeting of the Gas Committee of the Leeds Corporation last Thursday, a letter was received from the Secretary of the Operative Bricklayers' Society respecting the employment of bricklayers' labourers at the Meadow Lane and New Wortley Gas-Works. The writer alluded to a promise which he said was given by the Chairman of the Committee some time ago, to the effect that none other than recognized Union bricklayers' labourers should be allowed to work in conjunction with the bricklayers. After discussion, it was decided to intimate to the Society that the only promise given by the Chairman was that the bricklayers' labourers should be kept to their own work, and not put on other jobs. The Committee add: "While it is a matter of indifference to the Committee whether men employed by them are members of a Union or not, they do not consider it their business to require that men employed by them should belong to any Union." And so the matter rests for the present.

Dover Gas Company.—In moving the adoption of the report of the Directors of this Company, noticed in the "Journal" for the 1st inst., at the recent half-yearly meeting, the Chairman (Mr. Willsher Mannering) said it was pleasing to find that there had been a regular increase in the consumption of gas, amounting to 3·9 per cent., which had continued in the present year, notwithstanding the unusual mildness of the weather during the winter. Having compared the various items in the accounts for the past six months with those for the corresponding period of 1896, he proceeded to say, with regard to manufacture, that the usual excellent results had been obtained. In the half year 8879 tons of coal were used; the quantity of gas produced being 101,103,000 cubic feet; being equal to 11,386 cubic feet per ton. The gas accounted for was 93,812,000 cubic feet, or 10,565 cubic feet per ton; and the quantity actually sold was 92,785,100 cubic feet, or 10,449 per ton. The unaccounted-for gas was 7·2 per cent.—1 per cent. higher than in the corresponding half of last year. This was an ever-varying quantity; and the cause had never been properly explained. He concluded by saying that the concern owed a great deal of its success to the united efforts and energy of Mr. Herring and the efficient staff. He could not speak too highly of the faithful and valued services rendered by all the officers and workmen; and so long as harmony and good feeling prevailed, and each employee put his shoulder to the wheel, they might look forward to continuous prosperity. The report was adopted; and a dividend at the rate of 7½ per cent. per annum, less income-tax, was declared.

MISCELLANEOUS NEWS.

SHEFFIELD UNITED GASLIGHT COMPANY.

The Half-Yearly Meeting—A Reduction in Price.

The Half-Yearly Meeting of this Company was held on Monday of last week—Sir Frederick T. Mappin, Bart., M.P., in the chair.

The General Manager and Secretary (Mr. Hanbury Thomas) having read the notice convening the meeting,

The Chairman, in moving the adoption of the report and accounts—referred to in the "Journal" for Feb. 22, p. 415—said the shareholders, he was sure, would agree with him that the report was a very good one. The profit they had made during the past half year was £48,121, besides the interest on the reserve fund; and after paying a dividend at the rate of 10 per cent. per annum, amounting to £40,630, there remained a balance of £8480 to be added to the balance at July, 1897. Adding these together, they arrived at the sum of £21,905, which was carried forward to the present half year. The reserve fund now stood at its maximum—£86,192. The Board had considered the financial position of the Company, and the profitable working latterly, and had decided to reduce the price of gas to all consumers. When the Board first considered this matter, they decided to reduce the price 1d. per 1000 cubic feet. He had some hesitation in assenting to this; and at first he made the mistake of considering the loss of 1d. to amount to £9034 for the six months instead of for the twelve. When he discovered this, he felt satisfied that, instead of reducing the price 1d., the Company ought to reduce it 2d. per 1000 cubic feet; and after hearing his views, the Board endorsed them, and had now reduced the price 2d. per 1000 feet to all consumers—viz., to 1s. 10d., 1s. 8d., and 1s. 6d. per 1000 cubic feet, according to consumption. Their production now was a very large one; and if it was maintained as it was during 1897, the loss during the twelve months with the 2d. off would be £18,068. But he had no doubt that they would be largely recouped for the reduction, though not for the whole of it, and that they would have to use some of the large balance they were carrying forward to make up the amount required for the next dividend. He thought the consumers of gas had a right to expect the Company to look after their interests as well as their own. The public lamps would cost the City Council £1383 less than during the last year. All gas companies at their half-yearly meetings had deplored the adverse weather which they had suffered from. They said there had been no snow, no frost, and no black fogs. But in spite of this, the Sheffield Company had been fairly successful. In the corresponding half of 1896 they had an increase of 113,000,000 cubic feet; and last half year they had not only maintained this increase (in spite of adverse weather), but had a further increased output of 4,800,000 cubic feet, for which they received the sum of £432. Troubles in the engineering trade and the weather no doubt had affected their consumption; but the Company had fixed 2607 additional meters. They had sold 1332 gas-fires, 686 boiling and other stoves, and had let out on hire 191 cooking-stoves, and fixed 63 additional gas-engines. From these figures, he thought the shareholders might be well satisfied that the Company were in a prosperous condition. Chairmen of gas companies universally complained of the low price they had realized for their residuals; but this was not a complaint which he could join in, for there was only one residual, and that was tar, for which they had not realized as much as before, and even on tar their loss was only £77—the receipts being £9431, as against £9509 in the corresponding six months of 1896. The testing of their gas had been carried on as usual; and the 903 tests made during the half year showed an average lighting power of 17·83 candles, while for the twelve months 1829 tests showed an average of 17·77 candles. The standard which they were compelled to aim at was 16·5 candles; and the City Council appointed an official to test the gas, which could be done at any time that he fixed. The Chairman of The Gaslight and Coke Company of London, Sir Frederick continued, had recently made complaint of the small increase in gas sold, and the prolonged depression in the market for residuals; and this he said had necessitated a large draft on their reserve fund. This was not the first time that the Company had made drafts on their reserve, for in three years they had reduced the sum from £380,000 to £58,000, and for this period they had been paying 12¾ per cent. dividend. This was not the whole of the story; for at the beginning of 1889 they had a reserve amounting to £807,000, and they had reduced that in paying these large dividends to the small sum of £58,000. In 1888 they paid 13 per cent. dividend, and had £74,000 to carry to their reserve fund, notwithstanding that their output of gas was then smaller. He did not call this good management. He thought the shareholders of any Company were, under such circumstances, entitled to say to the Chairman that he should make way for a better man, and that the Board should be reorganized. Personally, he greatly regretted his inability to be present at the last meeting of that Company (he was engaged elsewhere), otherwise he would have attended and expressed his opinion, which was very strong. Bad management of a large Company like The Gaslight and Coke Company did not only injure itself, but it might affect legislation, which would interfere with the action and the interest of other companies that were well managed. In England, and on the Continent, the progress of the incandescent gas system for street lighting was very perceptible, as was evidenced by a town like Bradford, where they had 2500 such lights in their streets, and the same in Rome and Munich, which places were allowed to be better lighted than almost any other towns. Liverpool also, and Manchester, he had been informed, were lighting all their principal streets with the incandescent light. He was glad to see that the offer of the Sheffield Company to the City Council had been accepted, though as yet the Company had received no official communication to that effect. This mode of lighting was economical, as well as very beautiful and very effective. The demand for the burners was most surprising. Last year the Sheffield Company sold between 6000 and 7000 of them, besides what ironmongers, gas-fitters, and other people who dealt in them had supplied. The cost of this kind of lighting was in every way satisfactory, as they could see by contrasting the old style of gas-burner, consuming 4½ cubic feet per hour, and giving a light equal to 12 candles, with the new incandescent burner, which would only consume 3½ cubic feet per hour, and yet give a light equal to 50 candles. His only surprise was that

one saw anything but incandescent lights; and he was convinced that their universal use was inevitable. Turning to the subject of sulphate of ammonia, Sir Frederick said experiments had been continued upon Lord Rosebery's farm at Dalmeny, conducted by Mr. Hunter. For two years they had been carried on; and the results had been in every way remarkable. Lord Rosebery had stated that the experiments of the present year had in every way confirmed those of the preceding year, to the effect that sulphate of ammonia gave better results than nitrate of soda. Sir Frederick's next subject was the charges that are made for the supply of electricity for lighting purposes. An institution with which he was connected found that whereas in five years they had spent £251 for gas, electricity for a similar period had cost them £582. He noticed that the Sheffield Town Hall (a new building) had paid for the electric light for three months ending Dec. 31, 1897, the sum of £210 17s. During the quarter ending Dec. 31, 1895, the charges for gas consumed in the Town Clerk's office, the City Surveyor's office, the City Accountant's office, the Water Department, the Weights and Measures office, and the Health Department amounted to only £37 4s. 10d. He had expected to find a very great difference in the prices; but he had no idea that the ratepayers were being put to such an enormous expense as the difference between these two figures showed. He thought that if gas was so much cheaper, and as effective, the clerks employed by the Corporation ought to be satisfied with gas instead of electricity. The Worcester City Council had recently had accounts before them of the cost of lighting in the municipal departments by gas and by electricity; and the comparison to be drawn therefrom was most remarkable. The items were as follows: Guild Hall, gas for one year, 1894, £69 16s. 5d.; electricity for one year, 1897, £156 5s. Public Hall, gas, £52 8s. 6d.; electricity, £104 9s. Police Station, gas, £39 11s.; electricity, £44 15s. Market House, gas, £47 3s. 4d.; electricity, £80 3s. Town Clerk's office, gas, £6 15s. 7d.; electricity, £25 15s. In all, 110 public lamps were displaced by 55 arc lamps; and the annual cost had gone up from £330 to £1265 15s., and the cost of lighting the water-works building had gone up from £220 19s. for gas, to £650 10s. for electricity. Consequently Worcester, which formerly paid £797 5s. 6d. for gas in its public buildings, was now paying £2401 19s. 8d. for electricity. The conclusion was that one must not believe all that he heard about electricity being likely to approach the price of gas. Finally, Sir Frederick advised all gas consumers to spend a few shillings every year and have their burners thoroughly attended to, saying they would then get full value for their money, and have more satisfaction from the consumption of gas than if they kept the money in their pockets.

The resolution was duly seconded and adopted, as was one declaring a dividend at the rate of 10 per cent. per annum.

Alderman WILLIAM SMITH proposed a vote of thanks to the Chairman, and spoke in high terms of his abilities. With regard to the quality of the gas, he said that when he went into other towns he always felt that Sheffield was advantageously placed in having such brilliant and effective gas illumination. He confessed that Sir Frederick's figures regarding the comparative cost of gas and electricity were startling; and the question ought to be thoroughly gone into. In some respects one preferred, no doubt, the quiet light of electricity; but if it meant such a large increase in cost, a good many people would have to reconsider their opinions.

Mr. T. RICHARDSON seconded the resolution, and it was heartily carried.

The CHAIRMAN, in response, said the Sheffield Gas Company held a position equal to that of any gas company in the country. He took it that the resolution included his colleagues and also the officers of the Company. He could not hope to remain Chairman for many years; but so long as health and strength were given him, he should be very glad to do what he could for the Company.

WELSBACH INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

New Inventions and Enterprises.

The Statutory Meeting of this Company was held last Friday at the Cannon Street Hotel—Sir HENRY BURDETT, K.C.B., presiding.

The SECRETARY, *pro tem.* (Mr. G. A. Gutch), having read the notice convening the meeting,

The CHAIRMAN said he had always held the view that it was desirable that the statutory meetings of new companies should be held as speedily as possible after the allotment of shares. But their Company was not an ordinary new one, which could be dealt with in the usual way. It was a Company formed to take over several existing undertakings; and the completion of the arrangement for carrying out the amalgamation necessitated a great deal of time, an immensity of detail, and involved enormous trouble upon their solicitors and legal advisers. Had it not been for their zeal and devotion, it would have been quite impossible for them to hold the statutory meeting within three months of the date of the issue of their prospectus. The first meeting to liquidate the four English Companies was held on the 14th inst.; and the confirmatory meeting would be held on the 29th inst., after which the cash and shares on account of the holdings of these Companies would be handed over, as well as the dividends accruing up to Dec. 9 last. The labour and complications due to the completion of the purchase and winding up would be readily appreciated—especially as three of the Companies concerned were partly under Austrian and partly under English law. They had now made all the payments under the purchase contract in cash and fully-paid shares. The next point was that no application for a quotation and settlement of the stock and shares could be made until the stock certificates had been delivered; and this could not be done until they had completed the winding up of the old Companies. After this meeting, an extraordinary one would be held for the purpose of making certain alterations in the Articles which were required by the Stock Exchange; and when these had been confirmed at a meeting to be held on April 4, there was no reason why an application for a quotation and settlement should not be considered by the Stock Exchange Committee by the second week in April, and the application be at once granted. Certain misapprehensions had arisen in connection with the "Era" incandescent oil-lamp, which was referred to in the prospectus in the following words: "An oil-lamp for use with incandescent mantles will shortly be placed on the market; thus bringing the advantages of the Welsbach system within the reach of districts where gas is not obtainable." The misapprehension had arisen owing to the issue of the prospectus of the "Era" Incandescent Oil-Lamp Company, Limited. So far back as June, 1897, the Directors of the Incandescent Gas-Light Company were in communication with the patentee of the "Era" burner. The patent was for an oil-lamp to be used with the Welsbach or other mantles; but the patentee had no right to the Welsbach mantles, except through the Welsbach Companies here and abroad. After negotiation, it was agreed, with the full knowledge of the circumstances, that the Incandescent Gas-Light Company should, on payment of a royalty, acquire the exclusive licence for the use of the lamp in the United Kingdom and South Africa. On the other hand, the Welsbach Company agreed to give the "Era" Company all improvements in mantles suitable to oil-burners, including the Welsbach and other systems owned by the Company. The privileges acquired by the "Era" Company would be paid for by the allotment to the Welsbach Company of £10,000 fully-paid £1 shares out of a total capital of £60,000. The shareholders would readily understand the advantages of such an arrangement as this, inasmuch as, by the payment of a small royalty on the burner, the Company obtained the exclusive rights in it in this country and South Africa, and, in addition, a sixth interest in the whole of the business done by the "Era" Company in other countries. The formation of the "Era" Company would not entail any fresh issue of capital on the part of the Welsbach Company. How such a misapprehension ever arose, he was at a loss to understand, as such a step was never contemplated at the outset of the negotiations. The Welsbach Company were more interested in the development of the oil-lamp itself, as it formed part of their own business, and was receiving their best attention. The benefits of the arrangement, however, were not solely enjoyed by the Welsbach Company, as it must be obvious that the "Era" Company must gain materially by their connection with a well-established Company such as theirs. In the prospectus it was stated that "certain valuable patent rights now in course of arrangement will, it is considered, result in the Welsbach light presenting such additional advantages as will increase the popularity it has already secured." Thanks in great measure to Mr. Moeller—to whom the Company were more indebted than he (Sir Henry) fancied most of the shareholders realized—he had the satisfaction to announce that an agreement had been entered into with the owners of several British letters patent of this new burner on favourable terms. The advantages of the new burner might be described as follows: At present with the burner they used, they obtained an efficiency of about 17 candles per cubic foot of gas; whereas with the new burner, they doubled this efficiency. With their present burner, they diminished the efficiency if they increased or decreased the size of the burner; but with the new burner, the efficiency remained absolute whatever size the burner might be—that was to say, whether the burner consumed $\frac{1}{2}$ cubic foot of gas or 10 feet, or any intermediate quantity, the light given was always at the rate of 30 candles per foot of gas. This advantage was of the utmost importance, as it would enable them to meet the requirements of any and every class of consumer. For instance, they might go to lighting authorities who had public lamps burning 4 cubic feet of gas and giving consequently a very poor light, and offer them a burner consuming $3\frac{3}{4}$ cubic feet, but necessitating an extra expenditure for the renewal of mantles. These authorities at once met them with the argument that the Company would not save them anything; that they did not want as much as 60-candle power light; and that they certainly did not wish to increase their expenditure. In such cases up to the present, the Company had been unable to do anything, although they could supply a lamp that was comparatively economical, inasmuch as it would give four times the light with the same consumption of gas. But with the new burner, they would be able to say: "Very well, burn $\frac{1}{4}$ cubic foot of gas instead of 4 feet, and we will give you a better light; or burn 1 foot instead of 4 feet, which will give you more than double the light, with a saving of gas expenditure and so on." This applied, perhaps even more, in domestic lighting. In small houses with a three-light gasalier, it was quite unnecessary to put three 60-candle power lights in a room; and to put only one on such a gasalier would look very unsightly. One 60-candle power light would be all that would be required; and yet it could not be obtained without sacrifice of symmetry. With the new burner, however, they would be able to save consumers much gas, and give them exactly the amount of light they required, and no more. Another and very important advantage was that the new burner required no chimney, which not only made the burner look better, but resulted in a greater economy of mantles, as the frequent cause of destruction of mantles was the breakage of chimneys. He had no doubt that the introduction of the new burner would greatly increase their field of operations. He was much impressed by the new burner from the circumstance that he had seen, from experiments made at the works, that, when they had the new burners without chimneys and proper globes, they could light their houses decoratively and effectively, and with, he thought, an advantage from the fact that the gas gave off a certain amount of heat which electricity did not. The new burner was a most important feature in the history of the Company. He now came to a matter which was entirely new, and which had given the Board a great deal of anxiety and labour. It referred to further inventions by Dr. Auer. In the prospectus, it was set forth that the consolidation of the various existing Companies would abolish certain onerous arrangements by which considerable commissions had been paid out of the large profits earned in Vienna, and the cash working capital would be largely increased. The Board had determined, although they owned the great bulk of the shares in the local Austrian Company, to reconstruct that Company on a new basis. When a deputation of the Board arrived in Vienna, in order to acquire the control of the local Austrian Company by the purchase of the shares, they became aware of a very valuable invention of Dr. Auer, which they felt convinced must, if possible, be acquired by the Welsbach Company. This they at once reported to the Board in London; and one of the members of the deputation returned and laid before the Board tentative proposals which had been agreed upon between Dr. Auer and the local Austrian Company, subject to the Board's sanction. After prolonged and most difficult negotiation, an arrangement had been come to between the Company and Dr. Auer, which had been unanimously approved by the Board. The local Austrian Company would not be wound up, although the overwhelming majority of the present shares (to be hereafter known as "A" shares) would be owned by the Welsbach Company. The name of the Company would be altered to that of the Austrian Incandescent Gas-Light and Electric Company. The former articles of the Company had

been altered to provide for the establishment in one Company of two undertakings—"A" and "B." The holders of original or "A" shares were exclusively entitled to the property already acquired or hereafter to be acquired by the "A" undertaking; and they retained control over its assets and the profits realized therefrom, subject to the following arrangement: The "A" undertaking would lend to the "B," a sum which was fixed at a maximum of 1,100,000 florins, or £92,500. This sum was to be provided by placing at Dr. Auer's disposal 500,000 florins from the reserves, and a maximum of 200,000 florins each year for three years from the surplus profits of the "A" undertaking, subject in both instances to the understanding that only so much of the £92,500 would be used for the "B" undertaking as might be actually required, and that the whole of this amount, or so much of it as might be used for the "B" undertaking should be repaid to the "A" undertaking out of the profits of the former before any dividends were paid upon the "B" shares. So far as the "B" undertaking was concerned, Dr. Auer possessed absolute control as the holder of the majority of the shares of the reconstructed Company in general meeting. It was provided that undertaking "B" should pay interest on the sums advanced to it by "A" at the rate of 4 per cent. per annum, and should repay these advances with interest out of the next available revenue. The Chairman, having given further details regarding these financial arrangements, said that, by consenting to make a maximum loan of £92,500 at 4 per cent. to the "B" undertaking (which was secured as a first charge on the profits of the undertaking), the "A" shareholders not only retained their property and control over it, but they further acquired the right to participate to the extent of three-sevenths of the net profits of the "B" undertaking, after due provision had been made for the amortization, reserve, and capital funds to be provided out of such profits, in order to give the "B" undertaking the necessary financial stability. Briefly, the existing local Austrian Company would act as the banker of the "B" undertaking, and would agree to advance funds necessary for its development up to a maximum of £92,500 at 4 per cent. interest. Of this sum, rather less than one-half would come out of reserves of the Austrian Company which were to have been utilized as capital by the Welsbach Company. Apart altogether from the new invention of Dr. Auer in electric lighting, the new statutes secured other additions to the Welsbach Company. Dr. Auer had agreed to, and the statutes provided for, the acquisition and realization of all his inventions, and the patents and licences for the same which had reference not only to electric lighting but to electric power transmission, and the supply of current. This was most important, because they had reason to believe that Dr. Auer was now at work upon a new electric accumulator, which promised to prove of special value. Until Dr. Auer had completed his patents, and brought his invention to perfection as a commercial enterprise, it was not likely, so far as it was possible to forecast the future, that the new invention would produce profits for distribution until March 31, 1899. The invention had been seen by three members of the Board, and by Mr. Fletcher Moulton, Q.C., who had a high opinion of its merits. He (the Chairman) had never been more impressed with an artificial light. It was the nearest thing to natural light that he should imagine it was possible to attain to. The Board had taken the step of acquiring the right to this new invention; and they anticipated that it would consolidate into one undertaking artificial lighting. The Chairman concluded his speech by giving his impressions of a visit to the factory at Vienna and of Dr. Auer, who, he said, was a man of excessive caution, and believed that, before they distributed all their earnings in dividend, they should look to the consolidation and strength of the undertaking. This was the principle which he (Sir Henry) had adopted in taking the chair of this Company. It was to Dr. Auer's caution, and to the enforcement of these principles, that the strength of the local Austrian Company was due. Its accumulated reserve funds now represented the actual value of the whole of its capital as issued. In entering into the new arrangement, provision had been made which covered the whole of the inventive genius of Dr. Auer, in whom they had a gentleman who was animated by the soundest commercial principles.

Mr. WHITE, having referred to the thoroughly satisfactory statement which had been made by the Chairman, asked the extent of the area covered by the agreement with Dr. Auer.

The CHAIRMAN replied that it covered the whole world, with the exception of North and South America.

Mr. WHITE then moved a resolution tendering to the Directors the hearty thanks of the shareholders for the work they had accomplished.

Mr. OVENS seconded the motion, which was unanimously carried.

It was also agreed that the remuneration of the Directors should be fixed at £4000 per annum.

An Extraordinary Meeting was then held, at which resolutions were passed altering two of the Articles of Association, in order to meet the requirements of the Stock Exchange.

COLONIAL GAS UNDERTAKINGS.

The Diamond Jubilee of the Australian Gas Company.

The Half-Yearly Meeting of the Australian Gaslight Company was held at the Head Offices, in Sydney (N.S.W.), on the 31st of January—Mr. G. J. COHEN in the chair.

The SECRETARY (Mr. R. J. Lukey) having read the advertisement convening the meeting, the report and accounts were taken as read. In the former, the Directors congratulated the proprietors on the Company's Diamond Jubilee, which was attained on the 7th of September last—the Act of Incorporation having been passed on Sept. 7, 1837. The profits for the six months ending Dec. 31 amounted to £57,772; out of which the Directors recommended the payment of a dividend for the above-named period of 9s. per share, free of income-tax. This would absorb £51,135, and leave a balance of £6637 to be carried forward. The revenue from the sale of gas amounted to £175,157; the expenditure on its manufacture and distribution, and the repair and renewal of plant, being £100,257. The installation of incandescent gas-burners in the suburban lamps was completed in December last; so that the whole of the public lamps, numbering about 10,000, are now fitted with these burners, with satisfactory results. In September last the Company commenced fitting up small dwellings in Balmain, and supplying them with "penny-in-the-slot" meters; and up to the date of the report, more than 500 applications had been received, and the number was being increased daily. As these were all new customers on the existing line of pipes, an increased consumption of gas might be anticipated without any extra outlay for mains, particularly as it was intended to extend the system to the other suburbs, and also to the city.

The CHAIRMAN, in moving the adoption of the report, stated that there had been an increase in the consumption of gas, but the revenue had not recovered from the last reduction in the price from 4s. 6d. to 4s. 3d. per 1000 cubic feet. There had, however, been some compensation in the reduced cost of coal and the higher price received for residuals. The plant and works (which are under the supervision of Mr. T. J. Bush) were in excellent order, and working by machinery at the head station was very satisfactory, and resulted in a great saving of labour. There had been an addition of 126 to the number of public lights; making the total 10,044. The number of gas-cookers in use had been increased to 7944; a larger number having been sold than in any previous year. The day consumption of gas now equalled 33·4 per cent. of the whole. There was an increase of 51 miles in the main and service pipes laid, bringing up the total to 1190 miles. The number of consumers was 34,933. The "penny-in-the-slot" meters were being rapidly extended; and the 500 applications mentioned in the report had been increased to 560, with fresh ones coming in daily. The incandescent lights had been extended throughout the city and suburbs, at a cost to the Company of £11,173, and with a reduction of 5s. per lamp for the ordinary, and 10s. per lamp for 80-candle lights. As mentioned in the report, the Company attained its Diamond Jubilee on the 7th of September last; and a historical sketch would be published showing the progress made in the business, the reductions effected in prices, and other features of interest to the shareholders and the public.

The DEPUTY-CHAIRMAN (Mr. S. Dickinson) seconded the motion; and it was carried unanimously.

A vote of thanks was accorded to the Directors and officers; and the proceedings closed.

We have lately received the following particulars in regard to other colonial gas undertakings:—

In the six months ending Dec. 31, the North Shore (Sydney) Gas Company realized a net profit of £3029 from the sale of gas, &c. Adding the £68 brought forward, made a sum of £3097 available for distribution. At the half-yearly meeting on Jan. 28, the Directors recommended the declaration of a dividend of 3 per cent., free of income-tax, for the six months, absorbing £2700; other payments making up £3025, and leaving a balance of £72. This was agreed to. The Engineer (Mr. T. O. Morland) reported favourably on the condition of the works.

The Maryborough (Queensland) Gas Company had at the close of last year a balance of £1015 to the credit of the profit and loss account; the receipts having been £4174, and the expenditure £3159. The Directors recommended the payment of a dividend at the rate of 6 per cent. per annum, absorbing £771, and the carrying forward of £244.

The Directors of the Wellington (N.Z.) Gas Company presented a satisfactory report on the past year's working at the annual general meeting of shareholders on the 1st ult. The amount received for gas was £29,440; and for residuals, £3552—the total revenue being £36,186. The expenditure, including the interim dividend (£4995), was £28,406; leaving a balance of £7780. A further dividend of 5 per cent. was recommended for the six months, making 10 per cent. for the year; and this was agreed to. A sum of £2000 was written off for depreciation; and the remainder has been carried forward. In the course of the twelve months, extensions of the plant, including an additional retort-house and coal-store, were completed; and the works are now equal to all requirements.

GAS v. ELECTRICITY IN SOUTH AFRICA.

The Lighting of Woodstock.

A Public Meeting was recently held in the Municipal Hall at Woodstock, a suburb of Cape Town, to consider the question of the best means of lighting the town. The Mayor (Mr. G. C. Behr) presided; and there was a large attendance. It appeared from his opening remarks that when the Town Council first entered into a contract with the Gas Company, the price of gas was to be 8s. 4d. per 1000 cubic feet; but this had been raised to 9s. 2d. The price of street-lamps, to burn 1000 hours, was £4 2s. per annum. When the area was enlarged, the Directors of the Company said they would light the whole of the town with incandescent burners at £5 per lamp. Then the question of electric lighting was introduced. Mr. A. P. Trotter, the Electrical Adviser to the Cape Government, was consulted; and he recommended that an electric lighting scheme should not be adopted in Woodstock if it was to cost as much as it was supposed to do in Cape Town. If, however, the installation could be guaranteed on strictly economical principles, he advised the system, not only for public but for private lighting. For public lighting alone, he added, electricity would not probably pay. An offer had been received from a firm to lay down plant for £20,000; the central station to supply power equal to 2000 installed lamps. The price to private consumers would be at first 1s. 9d. per unit, with the prospect of a reduction to 1s. 6d. One of the speakers, a member of the Town Council, said he had approached the question with an open mind, and had come to the conclusion that the time for the adoption of the electric light had not yet arrived. Could they, he asked, expect to put down electric lighting plant to make it pay? A return of 4 per cent. on £20,000 was £800; and on the showing of the firm who proposed the scheme, if they supplied 600 lamps to private consumers in the town, the loss would be £800 a year. If 800 lamps were supplied, there would be a loss of £700; while if they had as many as 1200 lamps, they might get a profit of £50 a year. This number of lamps would represent an income of £3250, which was half as much as the income from private lighting in Cape Town, and not at all likely to be realized in Woodstock. He strongly advocated continuing with gas for the next five years; and this would give them time to consider the working out of an electric lighting scheme. He moved a resolution to the effect that the time had not come for the establishment of an electric light undertaking, and it was carried by a large majority.

THE SUPPLY OF WATER GAS IN LIVERPOOL.

A Death Attributed to Carbonic Oxide Poisoning.

At Liverpool last Tuesday, the City Coroner (Mr. T. E. Sampson) held an inquiry into the death of Sven Johann Erickson, a native of Sweden, whose death occurred under rather mysterious circumstances at a lodging-house in Great George Square, on the previous Saturday.

Mr. PIERCE, Assistant Town Clerk, said he appeared on behalf of the Corporation, who were interested in the matter in one or two capacities. In the first place the premises on which deceased had died was a registered lodging-house for one of the shipping companies; and, secondly, it had been suggested that there was something peculiar in the quality of gas supplied to the house.

Mr. P. F. GARNETT, Secretary to the Gas Company, remarked that he was present to give the Coroner every assistance in his power.

Johann Johannsen, a Swedish emigrant to America, was the first witness called. He stated that deceased, two other emigrants and himself, put up at the lodging-house on the Friday evening. At half-past nine, three of the party went to bed; but deceased sat up writing a letter on a table beneath a gas-jet. Witness did not remember anything more until a quarter to eight the next morning, when he was dragged out of bed. He was almost unconscious, but soon recovered. He was then told that Erickson had died.

The other two occupants of the room gave similar evidence.

Mrs. *Maddox*, wife of the proprietor of the lodging-house, said that about eleven o'clock on the Friday night she went through the bedrooms to see that all was correct. The three Swedes were asleep in bed; and deceased was still writing his letter. She did not mention anything to him about turning off the gas, taking this for granted. Next morning another inmate of the house (who had since gone to America) told her that he had observed a strong smell of gas in the room occupied by the Swedes, and that he had opened the door. Witness ran upstairs and found that the gas was not burning, but that the tap was turned on, and the room full of gas. She immediately threw open the window, and then noticed that the deceased was lying on the floor with his face pressed downwards quite dead. Another of the occupants was lying under the bed in an unconscious condition, as if he had attempted to creep out; and the other men were in bed unconscious. She at once sent for a doctor, who managed to revive the three men.

Mr. *C. R. Bellamy*, the Gas Superintendent of the Corporation, deposed to having examined the gas-fittings in the room. He found them in a fairly sound state. The room was 8 ft. 8 in. wide by 10 ft. 9 in. long, and 10 ft. 4 in. high, with a cubic capacity of 962 feet. The burner with the same pressure as was existing at 11 o'clock on Friday night would pass 7½ cubic feet per hour. The room had two ventilators, but the larger one was closed; and there was no fireplace. The inference was that deceased had blown out the gas. Assuming that coal gas was pouring into the room, and that asphyxia did not take place, the poison being carbonic oxide, six hours would elapse before the man would be incapacitated. Supposing that a 50 per cent. mixture of water gas was used, the men would be incapacitated in two hours. In the case of water gas the paralysis was very sudden indeed.

Replying to Mr. PIERCE, witness said he was aware that water-gas plant existed at Garston; and he had asked for information about it from Mr. William King, the Engineer to the Gas Company. But in view of a Home Office inquiry at which Mr. King would give evidence, that gentleman thought it advisable not to impart the information. As soon as water gas was introduced, precautions ought to be taken in regard to the fittings. He certainly believed that the consumer ought to be notified of the introduction of water gas; and he believed in America this was done.

By Mr. GARNETT: If Mr. King had been to America, and found that no such notice was given there, he would accept such a statement. He had heard of deaths by coal gas; but they were very few—only about ten per annum. Water gas was a brilliant illuminant.

Witness added, in reply to a question from the Jury, that with 50 per cent. of water gas mixed with coal gas the proportion of carbonic oxide would be 19 per cent.

Dr. *Paul* stated that he had made a *post-mortem* examination of deceased. He found no smell of coal gas about the body. Practically the whole of the body was a bright pink colour; and there was no blueness or lividity. The colour was due to carbonic oxide poisoning, of which the colour was characteristic. The muscles and interior organs were of a similar colour. Death was due to carbonic oxide poisoning; and an examination of the blood confirmed this view.

Cross-examined by Mr. PIERCE, witness said there must have been a larger percentage of carbonic oxide than was found in ordinary coal gas. In the atmosphere 1 per cent. of the gas was a poisonous amount. He was quite of opinion that notice should be given to consumers of the supply of water gas. He would be very chary of using it in his own house.

In reply to Mr. GARNETT as to whether he gave his opinion as a medical man, witness said he gave it as a common-sense opinion.

Mr. GARNETT remarked that he had used the gas in his own house for twelve months.

Mr. *William King* said he had been Engineer to the Gas Company for 32 years, and had been to America to investigate the manufacture and supply of carburetted water gas. On his return to this country, he recommended his Company to make experiments at their works at Garston. This was done in 1895; and for eighteen months or two years, the gas was supplied pure in that part of the district. For the last year and a half, it had been supplied mixed with coal gas. The smell of carburetted water gas was precisely similar to that of coal gas, and could be detected quite as readily.

Mr. GARNETT: What was the composition of the gas sent out from the works to Great George Square on the night of the occurrence between eleven o'clock and the morning?

Witness: That of ordinary coal gas.

In answer to Mr. PIERCE, witness said it was more convenient to supply ordinary coal gas at night; and simply as a matter of convenience it was done. The Company did not give notice when they supplied water gas.

Questioned by the CORONER, he said he could not say definitely of his own knowledge that coal gas was supplied on the night named. But his instructions were that, for their own convenience, coal gas was to be supplied during the night; and he believed this was done.

The CORONER, in summing up, said that it was important for people to know the kind of gas they were using; and the mind of the public should be set at rest, or the full facts of the question put before them. The inquiry was, therefore, of much importance.

After retiring to consider their verdict, the Jury found that Erickson died from carbonic oxide poisoning.

At the Meeting of the Corporation Health Committee on Thursday, the Medical Officer (Dr. Hope) presented a report on the above deplorable occurrence. He said: "At the inquest the question arose as to whether or not the gas supplied to the house was ordinary coal gas, with which the public are familiar, or whether a more poisonous gas was being supplied. It was admitted that for some time past water gas had been supplied to that part of the city in varying proportions; and as water gas contains between 30 and 40 per cent. of carbonic oxide, and ordinary coal gas contains about 4 per cent., it is evident that the danger to the public is increased in proportion to the amount of water gas sent into the dwellings. The public are fairly familiar with the uses and dangers of coal gas, and generally speaking adopt means to protect themselves from those dangers; but at the same time it must not be overlooked that small defects in fittings which might not, with the ordinary coal gas, result in injury, might reasonably be expected to give rise to serious consequences if a virulently poisonous mixture is, without warning to the public or any notice whatever, substituted for coal gas. In view of fatalities that have occurred, a Departmental inquiry is at the present time being held into the use of water gas. Pending the results of this inquiry it is desirable that gas of the excessively poisonous character of carburetted water gas should not be sent into dwelling-houses or places of business without ample public warning being given, in order that the consumer may protect himself as far as possible from any injurious consequences which may result."

The CHAIRMAN (Alderman Cookson) thought it necessary under the circumstances that the Committee, as being responsible for the public health, should make a representation to the Gas Company that, in view of the danger to consumers of gas, the Company should give notice in all cases where they supplied water gas.

Mr. MEADE-KING said he understood that the Company supplied water gas during the day time and coal gas at night.

Dr. BLIGH was under the impression that the Gas Company had been supplying a mixture of coal and water gas. He came to this conclusion because he noticed when sitting in front of a gas-fire at home the peculiar effect of the carbonic oxide on himself. It had been stated that the Company did not mix the gases until one or two o'clock a.m.; but he could not help thinking that the water gas was distributed with the coal gas at a much earlier hour. Were there no means by which the Council might interdict the mixing of these two gases? This was a matter of great importance, and one the Committee ought at once to take in hand. Water gas was supplied because he believed it was much cheaper to produce. Personally he hoped the Corporation would at some time to come take over the gas supply.

Mr. G. JONES also remarked that it was the absolute duty of the Committee to protect the public, and at any rate see that they were properly warned against this serious danger.

Mr. HARTLEY WILSON said he and his family had suffered from the effects of water gas.

Mr. PURCELL asked whether they could not deal with this matter in their next application to Parliament.

Mr. PIERCE (Assistant Town Clerk) said any representations from the Committee would be received by the Gas Company with attention; and he would suggest that Dr. Hope's report be sent to them.

The Committee adopted a suggestion that the Town Clerk should make a representation to the Company on the subject.

WARRINGTON CORPORATION GAS SUPPLY.

The Gas Committee's Policy Criticized.

At the Meeting of the Warrington Town Council last Tuesday—the MAYOR (Alderman J. E. Wright, J.P.) in the chair—the policy of the Gas Committee came under discussion.

Mr. H. ROBERTS submitted the following resolution—"That the Gas Committee be instructed to furnish a report to the Council showing the amount of money charged in the cost of the manufacture of gas for (*a*) all renewals and repairs rendered necessary by ordinary wear and tear, (*b*) all renewals or replacements caused by any other circumstances—the causes of such renewals or replacements to be set out in the report, and (*c*) all additions to plant, mains, or buildings, temporary or permanent; the report to cover the period from Jan. 1, 1890, to Dec. 31, 1897, and to show the cost separately for each year." He said he wished it to be distinctly understood that the object of the resolution was not in any sense to make an attack of a personal character either upon the Committee or upon any official under their control. The sole purpose he had in view was to prevent the continuance of a policy which, if his deductions from the report of the Gas Engineer (Mr. W. S. Haddock) were correct, was manifestly unfair to the present ratepayers, was unwise from a financial point of view, and was calculated to create suspicions as to the true condition of things which would not otherwise arise. The gas-works had been the property of the Corporation for about twenty years. When they were originally purchased, it was anticipated that they would speedily become a source of material help to the rates of the borough, by means of large annual contributions from the profits; but up to the present they had been most disappointing, and by no means representative of what the profits should have been. It was true that there had been some reduction in the price of gas and in the charge for street lighting, and that altogether something like £4000 had been contributed in relief of the rates. But the total amount had been infinitesimal compared with what was anticipated, and with what ought to have been made. The question then arose: Why had the beneficial contributions been so paltry? Having given details of the cost of manufacture for several years, he went on to say that the gross total extra cost of gas making, over and above the average normal cost, during the years 1891 to 1897 amounted to

£37,200. If this large sum were all that had to be accounted for, it would be sufficiently serious to justify his motion. But there was a further sum to be taken into account. Owing to the repayment of principal, the statutable charges became lower—amounting from 1892 to 1897 to a total of £12,750. This added to the £37,200 made a total of £48,950; but deducting £4000, the extra cost of coal during the strike, there was left £44,950. He did not, of course, pledge himself to the absolute accuracy of these figures; but they represented the facts as nearly as could be ascertained from the Engineer's report. What was the explanation of this extraordinary condition of things? The only solution that suggested itself to his mind was that the Gas Committee had been charging against the cost of gas manufacture a very large portion of the sum he had arrived at, which ought to have been charged to capital. In proof of the inference he had drawn, he found that while in 1893 a loan of £20,000 was sanctioned by the Local Government Board and afterwards obtained, more than £4000 of the money had not been taken up. This should have been utilized by the Committee, instead of absorbing the amount from the revenue account. Again, in June, 1897, the Committee came to the Council with an application to borrow £10,000 for providing slot meters and £20,000 for gas-works extensions. The first part of the resolution, referring to the purchase of the meters, was approved and adopted; the second part being referred back to the Committee for the production of estimates and plans. From that date until now no further communication had been made by the Committee to the Council in reference to the proposed loan. Either it was required or it was not. If it was required in June, 1897, surely it was still necessary for the purpose of extensions. If it was not required, it ought not to have been asked for. The conclusion he had come to in regard to this particular loan, was that the money had been provided from other sources—in other words, that the extensions had been made a charge against the revenue account, instead of against capital. Under the heading "Repairs of iron and brick work" there had been an enormous increase of expenditure. Taking the average of 1889-90 these expenses amounted to less than 2d. per 1000 cubic feet. The increase in the years 1891 to 1897 totalled up to £27,700 under this one head. If he was right in assuming that this had been, and was still, the policy of the Committee, then with all respect he unhesitatingly asserted that the policy was not only manifestly unfair to the ratepayers of to-day, but was also illegal. It might be impossible to recover very much of the round sum of £50,000 which he said required accounting for by the Committee; but his purpose would be served in a great measure, and the burgesses of Warrington would be fairly satisfied, if the Committee would from this time give them their assurance that their future policy at any rate would be guided by a proper and due regard to the interests of the present ratepayers, and that under no circumstances would they permit any charge to be made against revenue which could be properly and legally charged against capital. If this policy were pursued, there would be received from the Committee in aid of the rates the sum which, in his opinion, from the figures he had considered, ought not to be less than £4000 or £5000 per annum. The improvements which were so desirable and so necessary, if the progress of the town was to be maintained, ought to be carried out at the least possible cost to the ratepayers; and in order to bring that about, the gas undertaking, which should be a profitable one, should do its share by making as much money as it could, and by handing over as much as possible in relief of the enormous expenses of the borough.

The Deputy-Mayor seconded the motion; remarking that the Gas Committee were quite willing to have the fullest inquiry made.

The motion gave rise to some discussion, at the close of which

The Mayor remarked that, as a member of the Gas Committee, he ventured to say that the course they had hitherto pursued had been thoroughly approved by the Local Government Board. At the same time he thought they had taken rather more than they ought to have done. It had been a safe course to follow; but he did not think they ought to have pursued it.

The motion was carried.

LEICESTER CORPORATION GAS AND WATER SUPPLY.

Half-Yearly Reports.

The half-yearly reports of the Gas and Electric Lighting and Water Committees were presented at a special meeting of the Leicester Town Council last Wednesday.

The Gas and Electric Lighting Committee reported that the net profit for the half year ending Dec. 31, after paying interest on capital, was £11,923. Out of this had been paid £4935, the half-year's amount of sinking fund; leaving a balance of £6988, which, added to the balance of net profit (£10,021) for the half year ending June 30, made a total of £17,009 to be applied to the district fund at the close of the current financial year (March 31) or from which the Council might, if so minded, increase the present reserve fund of £5000 or set aside a sum to be applicable for the renewal of works. The Committee recommended that the total net balance of £17,009 be applied to the district fund. The accounts of the electric lighting undertaking for the half year, after paying interest on capital and £582 on account of sinking fund, showed a profit of £449. Deducting this amount from £1819 loss to June 30 last, there was a net loss in connection with this department of £1370. The total amount which had been paid on account of sinking fund was £3741. Good progress, the Committee added, had been made with the extension of the Aylestone Road gas-works, and also with the apparatus in connection with the electric lighting works; and it was anticipated that both would be completed in good time to meet next season's requirements.

Alderman Lennard, in moving the adoption of the report, said that notwithstanding the increased business the accounts showed that the gross profits were roughly £1000 less, and that they had £2000 extra sinking fund to pay. Speaking of the bye-products, he remarked that fully five-tenths of their sulphate of ammonia had been sent to the Continent for beetroot cultivation, &c. It was the best and cheapest high-class manure that could be used; and in the opinion of authorities on the subject, this fact had only to be realized by British farmers for the product to be largely used by them.

Mr. Billings seconded the motion, which was unanimously carried.

The Water Committee reported a net profit for the half year, after paying interest on capital, of £6096. Out of this had been paid £3089, the half-year's amount of sinking fund; leaving a balance of £3007, which, added to the balance of net profit (£1080) for the half year ending June 30, made a total of £4087. The Committee recommended that £1500 be transferred to the reserve fund, and that the balance of £2587 be paid to the district fund. The quantity of water delivered during 1897 within the limits of supply was 1,422,393,589 gallons; and the average consumption per head per day, 17·19 gallons. This also included the quantity supplied for trade purposes. The number of houses on the books at the end of December was 45,332; giving an estimated population of 226,660.

Alderman Wood, in moving the adoption of the report, said that considering the large capital outlay of this department, a great portion of which, such as the Swithland reservoir, was at present unproductive, it was satisfactory they had so large a balance as £4000 to their credit. The rainfall during the last three months had been very remarkable. He did not want to sound an alarmist note; but if they did not have rain in the near future, he was not sure they might not have some trouble this year. The Committee had had an interview with the authorities at Loughborough, to see whether it was possible to take from them their surplus water; and negotiations were still going on. They had sufficient water at Loughborough to supply over 100,000 people. He had also taken the opportunity on several occasions recently to sound their friends at Birmingham, with a view to procuring a supply of Welsh water. This latter he regarded as by far the most splendid supply that could be obtained for Leicester. The quantity and quality would be reliable, and would justify reasonable expense in conveying it 36 or 37 miles. He sincerely hoped to see the day when that source of supply would be available.

Alderman Coleman seconded the motion, which was adopted.

ELECTRIC LIGHTING NOTES.

The Garston District Council last Thursday decided to apply to the Local Government Board for powers to borrow £25,000 for the erection of an electrical generating station and refuse destructor.

The Lighting Committee of the Liverpool City Council last Friday adopted several recommendations of the Electrical Engineer (Mr. A. B. Holmes). In the first place, the scale of charges is to be altered as follows: For lighting purposes, 7d. to 5d. per unit for 1000 units and under per quarter, and 4d. per unit above 1000 units; for public buildings, 4d.; for street lighting, 3d.; and for motive power, 2d. An extension of the electric mains is to be made, and the first instalment of the cables for the tramways is to be laid, at a cost of £13,023. One of the generating stations is to be extended at an outlay of £1281. It was reported that the number of customers is now 71,283.

The shareholders in the Dover Electricity Supply Company, Limited, had cause for satisfaction at the account presented to them, at the annual general meeting on the 9th inst., of the results of the working of the undertaking in the past year. Though they were not in the excellent position occupied by their friends in the Gas Company, who a few days previously had the gratification of receiving the full dividend of 7½ per cent. per annum upon their investment, they were nearer the declaration of a dividend of any kind than they were last year. At that time the Chairman (Sir W. Crundall) said they were "next door" to it; but he acknowledged that he ought to have said "next door but one." However, the accounts for 1896 showed a loss of £456; whereas those for 1897 show a gross profit of £1127 17s. 5d. In the former year, the receipts amounted to £2838; the expenditure, to £3294. In 1897, the revenue was £5248; the expenditure, £4070. The increase in the receipts was nearly 85 per cent., while the working expenses went up only 24 per cent. The units sold in 1896 were 154,200; those sold in 1897 were 243,111, or an increase at the rate of 58 per cent. The Company decided to adopt the Brighton system of charging as from July last, with the view of inducing an increased average daily use of electricity. According to the Secretary (Mr. F. E. Beeton), every unit sold in 1897 was charged at an average price of 0·3d. less than in 1896.

It has been supposed by many that the incandescent electric lamp does not give off heat; and when they are told by anyone connected with the gas industry that the contrary is the fact, they seem to be only the more strengthened in their opinion. It may therefore be of interest to place on record what the "Lancet" says on this subject: "So firm is the idea that the incandescent electric lamp is free from heat, that in shops it is frequently to be found buried in a mass of easily ignited and highly inflammable material. This is a mistake, and care should be exercised with the electric lamp in its application in this connection. We have found by experiment that on immersing a 16-candle power lamp, at 100 volts pressure, in half a pint of water, the water boils within an hour, and in proportionately less time when a 32-candle power lamp is substituted. If, again, the lamp be buried in cotton wool, the wool soon begins to scorch, and ultimately to burst into flame. In one experiment which we tried, the bursting of the wool into flame was accompanied by a loud report, due to the explosion of the lamp. It clearly appears from this that the incandescent electric lamp cannot be regarded as an unlikely means of starting a serious fire; and shopkeepers, especially those who exhibit highly inflammable fabrics, should know that there is risk in placing such goods too close to the lamp. The lamp in contact with celluloid fires it in less than five minutes; and therefore the danger is particularly obvious in the case of toyshops, where electric incandescent lamps are often suspended in the midst of toy celluloid balls."

In order "to popularize the electric light and to induce prospective consumers to become actual ones"—to quote the words of Mr. J. H. Rider, the Electrical Engineer of the Corporation of Plymouth, the Corporation have decided upon the adoption of an easy wiring system. The so-called "free" wiring system, under which the cost of fitting up premises for the electric light is made a charge upon the price of the current, is severely criticized in Mr. Rider's report on the subject. An obvious objection to it, as previously pointed out in the "Journal," is that it is unfair to the better customers, for the longer the light is used and the greater the amount of current taken, the more they have to pay for fittings. Mr. Rider also objects to the Corporation becoming the collector of the debts of the "free wiring" people. His own plan is, however, not free from this objection. He proposes that the Corporation shall undertake to pay accounts for

fittings; deducting a discount of 5 per cent. from the bill, and collect the amount from the consumer in full in eight equal quarterly instalments. By this means, the consumer will get credit equal to 10½ months on the full amount, and (the Corporation having the discount instead of the customer) will pay 5 per cent. for the accommodation, or at the rate of about 5¾ per cent. Many advantages are claimed for the system. The Corporation, it is said, will get many consumers who could not afford to pay for fittings right out, besides which they will be able to exercise control over the wiring of premises, and so raise the standard of work. The consumer is to get the advantage of a cheap outfit and good work, and not to be burdened by a continuing extra charge for wiring; while the contractor will benefit by the system of cash payment.

The customers of the Bedford Corporation electric light installation have just held an indignation meeting to demand an immediate reduction in the price of current. There was some candid speaking. The Chairman (Mr. Dudeney), who is a large provision merchant and grocer, said his bill in Bedford for electric lighting was very heavy last year. He had a shop at Brighton, where the cost came to about 3½d. per unit; but the great expense prevented him from using it further in his Bedford premises. If the Corporation could charge 2½d. for town lighting and 6d. to private consumers, they must either be making a very big profit out of the latter or were losing by the public lighting. Mr. Barnes, a member of the Town Council, said the Corporation had £15,000 worth of plant lying practically idle; and if they had not to pay interest and capital charges, their profit would have been £1200 instead of a deficit of this amount. Mr. Luddington, a large tobacconist, said it cost him more to light his window with electric light than it did his shop and the whole of his house with gas. Other consumers present made similar statements. The meeting appointed a deputation to wait on the Town Council Committee, who are now considering "the urgent necessity of the profitable utilization of the day-load at the works." It was announced on Thursday that the Committee had decided to reduce the price to 4½d. per unit from the 1st of July next. A member of the Institution of Civil Engineers has sent to a Bedford paper some striking statistics on the comparative cost of gas and electricity. He has kept a careful record of his lighting expenses, and he finds that during the three years 1894 to 1896 his bill for lighting with gas and a small amount of oil was, on an average, £10 10s. He then installed the electric light, and last year, spite of most economical use, the cost was £27 5s. He states that whenever a room was vacant the current was switched off, while with gas the lights would be frequently left burning till the family retired to rest. He says: "It is not to be wondered at that I have now gone back very largely to the use of gas, and will continue to do so until the Corporation reduce the cost."

The inauguration of the municipal electric lighting plant at Torquay was characterized by one of those incidents which occasionally occur to remind electrical engineers that they are not infallible. The light was switched on by the Mayoress (Mrs. Harrison) on Thursday evening; and the Corporation and a number of other people celebrated the event by the inevitable banquet. After the banquet came speeches eulogistic of the new method of illumination and of the enterprise of Torquay. In the midst of a reference by the Town Clerk to electricity as the light of the future, the light, with more than ordinary perversity, suddenly went out, and the gas had to be lit. The interruption only lasted a few minutes; but it extended to the whole of the light in the streets as well as those in the hotel where the councilmen and electricians were banqueting; and it afforded a comical comment on the speech which Alderman Kerswill, the Chairman of the Electric Lighting Committee, had just made on the advantages of electricity over gas. "In its earlier days," said Mr. Kerswill, "the electric light sometimes played tricks with its consumers; but now this has been mastered, and the light is more steady and reliable than gas." It was, nevertheless, satisfactory to the guests at the banquet to find that the gas-fittings had not been removed from the hotel. Apart from this incident, the inauguration of the light seems to have been a success. It is true the completion of the works has been delayed for about six months, and the trade of one winter has been lost. This, however, is due to the engineers' strike rather than to anything which the Corporation or their Engineer (Mr. W. H. Trentham) could control. It is true also that the expenditure has exceeded the estimate—or, rather, that the whole of the money has been spent while the original undertaking has not been completed. On the other hand, what has been done is claimed to have been carried out in the best possible manner. Mr. Trentham presented three reports to the Town Council between the years 1893 and 1896. Sanction was obtained from the Local Government Board for the borrowing of £23,000; and the works have cost this amount. One thing the Corporation have had the courage to do was to disassociate the electric lighting works from the refuse destructor. This was partly due to the fact that it was difficult to find a site in which the two could be combined. But, whatever the cause, the electric lighting station is completed at the end of Beacon Quay under the Bath saloons, and a destructor is being built at the opposite end of the town. Mr. Trentham claims that, by excavating into the rock for a solid foundation, the danger of vibration being felt in the Assembly Rooms over the generating station has been got rid of. The system adopted at Torquay is that of the high-pressure alternating current, with transformers. The Engineer puts the cost of the plant at £52 per unit of the total output, which he says is lower than that of any other undertaking in the country, except Bradford. Consumers are to be charged, on the Brighton system, at the rate of 7d. per unit for the first hour, and 3d. per unit afterwards. An all-night supply is promised for September next.

The Electricity Department of the Coventry Corporation has failed to pay its way; and this fact has elicited a few observations from "A Gas and Electrical Engineer" in a recent number of the "Coventry Herald." The failure has been attributed to the number of units sold per 8-candle power lamp averaging only 11¼, which is said to be very low—in fact, much under the average of other corporation undertakings. The critic thinks this contention cannot be supported, for an average of 11¼ units sold per 8-candle lamp is, he says, well above the average of similar electric supply works to those at Coventry, where private lighting (profitable) only is done. Every place which has been mentioned in support of the above statement has much public electric lighting; hence the higher averages. The writer points out that there is a vast difference in the time a domestic light would be used and a light for public purposes; and, roughly, it may be taken that if an 8-candle lamp used in a house or shop 10 units per annum, a similar lamp in the streets would consume 60 units. In further proof of his remarks he has taken Bedford, where both private and public lighting is done by the Corporation on a system of supply similar to that at Coventry. The figures relating to 1897 are approximately as follows: Private lamps (11,600), 129,508 units; public lamps (1400), 126,482 units—total, 255,990 units. These figures show that the current sold averages 11·16 units per private 8-candle lamp, and 90·34 units per public one. The Bedford station was opened in 1894, and last year there was a deficit of £1200. The writer says the real causes of the deficit at Coventry appear to be that the amount of current sold per kilowatt of plant installed is very low indeed—about half the average of similar stations—and that the department, not being governed by the necessary commercial principles of a company, have unproductive mains, and have sold current at too cheap a rate. He goes on to remark: "In view of these assertions, the responsibility of the Council in granting permission for some extensions, and, in consequence, an increased capital account, is a serious one. The old and really deceptive plan to balance accounts is apparently to be now adopted at Coventry—viz., public arc lighting. From the published reports, I gather that for a certain number of streets which could be efficiently lighted with incandescent gas-lamps at a cost on the rates of £255 per annum, arc lamps are to be adopted. To these lamps, called 2000-candle power nominal, or 1000-candle power actual, and, as a matter of fact, not more than 500-candle power on an average, any value can be given; but the actual cost of each (on the rates) may be taken at £30 per annum. If, therefore, a sufficient number of arc lamps are erected, the deficit in the accounts of the Electricity Department may vanish (on paper); but assuming the deficit of 1897 to be repeated, it is at once obvious that the rates suffer to the extent of £1303 per annum (£1558, less £255 for gas displaced). Ratepayers will be told to look at the increased amount of light, &c. Perhaps some did not want it; and what benefit can it be to those who do not live in the favoured streets? Certain it is that but for the infatuation of electricity no such change would be made; and it is for the ratepayers to protect themselves. In my opinion, every corporation supplying gas or electricity, or having tramways, should work the same to make ends meet, and at the cost of working. Thus, users of the electric light should pay what the current costs, and not have such benefits at the expense of the whole body of ratepayers."

Tin-Lined v. Lead Water Pipes.—A proposition has been before the Oldham Corporation Water Committee to substitute tin-lined for ordinary lead water pipes; and a member of the Council has been making an estimate of the cost. He finds that a cottage house requires about 56 lbs. of lead piping; and if this were tin-lined it would cost about 15s. If the ordinary block tin used by the Corporation were adopted, the price would be 11s. 9d., and the work as usually done by plumbers would cost about 7s. 6d.

Fatal Accident at the Falmouth Gas-Works.—An inquest was held at Falmouth on Saturday week on the body of a man named Nicholas Bennett Brokenshire, who died through injuries received at the gas-works, where he was employed. Deceased and a mason named Barnicoat were engaged in the retort-house erecting brackets to carry a pipe. The scaffold in use consisted of two iron bars inserted in the wall, two planks, and a rope attached to the principals. The rope gave way, and Brokenshire fell, sustaining injuries to his head which proved fatal. Barnicoat burnt the rope after the accident, in order, as he explained, that it might not be used again. He admitted that it had been in use a week in the vicinity of the furnaces; and a juror with some practical knowledge suggested that exposure to the heat, the fact that it was fastened to a square iron bar with sharp edges, and the weight of the two men on the platform, would cause it to break like a thread. A verdict of "Accidental death" was returned. The Jury held, however, that Barnicoat was much to blame for not renewing the rope when it became rotten; and they advised that chains instead of ropes should be used in such hot places. Mr. J. W. Buckley, the Manager of the works, said the Company were at all times ready to provide anything required for the carrying on of the business in safety.

Wrexham Gaslight Company.—At the recent annual meeting of this Company, the Directors had the satisfaction of announcing a continued increase in the receipts. The sale of gas during the year produced £9951, as against £9472 in 1896; and the residual products realized £1762, being an increase of £117. Regarding the works, the report stated that the results obtained by the adoption of regenerative furnaces in the new retort-house had been even better than the Directors anticipated, and they had under consideration plans for carrying out a similar system in the old retort-house. The Directors recommended that dividends be declared at the rates of 10 and 7 per cent. per annum. In moving the adoption of the report, the Chairman, Mr. J. O. Bury, alluded to the deplorable accident which occurred at the works last October, by which the Assistant Manager (Mr. S. Hesketh) lost his life in attempting to stop an escape of gas under one of the purifiers. While deeply regretting the loss of so valuable a life as that of the late Mr. Hesketh, who had been some years in the service of the Company, the Directors wish to record their warm admiration of the bravery displayed on the occasion by Messrs. T. B. Walker and Henry Perrin, in their efforts to save his life—bravery which was rewarded by the issue of medals to both by the Royal Humane Society. Shortly after this unfortunate occurrence, the Directors engaged Mr. Robert Hunter, Engineer to the Chester Gas Company, to make a thorough investigation as to the cause of the disaster, and to generally report upon the condition of the works. With regard to the cause of the accident, he need only say that Mr. Hunter fully confirmed the opinion given at the inquest. His report upon the state of the works had received very careful consideration by the Directors, who proposed to carry out during the coming summer those of the recommended renewals and additions to the works which they felt were absolutely necessary; leaving the remainder to be dealt with by degrees in the future. The outlay was necessary; and the bulk of it would have to be charged to revenue. The principal items of the proposed expenditure were the renewal of one of the gasholders, the provision of two new boilers, and the demolition of the retort-benches in the old retort-house, and substituting generator furnaces in place of the ordinary furnaces at present in use. The estimated cost of carrying out these alterations was at least £2000. The Chairman also referred to the resignation, through ill-health, of the Secretary and Manager (Mr. Thomas Walker), as recorded last week. The report was adopted.

METROPOLITAN WATER SUPPLY COMMISSION.

Fifteenth Day—Monday, March 14.

(*Viscount* LLANDAFF, *Chairman, Sir* JOHN E. DORINGTON, Bart., M.P., *Sir* G. B. BRUCE, M.Inst.C.E., *Major-Gen.* A. DE COURCY SCOTT, R.E., Rt. Hon. J. W. MELLOR, Q.C., M.P., *Mr.* A. DE BOCK PORTER, C.B., *Mr.* H. W. CRIPPS, Q.C., *and Mr.* R. LEWIS.)

The Commission sat at the Westminster Town Hall.

The following are the Counsel engaged: Mr. POPE, Q.C., and Mr. CLAUDE BAGGALLAY, Q.C., for the New River Company; Mr. LITTLER, Q.C., and Mr. LEWIS COWARD for the Kent Water Company; Mr. PEMBER, Q.C., for the Lambeth, East London, Grand Junction, and West Middlesex Water Companies; Mr. RICKARDS for the Chelsea Water Company; Lord R. CECIL for the Hertfordshire County Council; Sir JOSEPH LEESE, Q.C., M.P., for the Kent County Council and Kent Local Authorities; Mr. BALFOUR BROWNE, Q.C., and Mr. FREEMAN, Q.C., for the London County Council; Sir R. NICHOLSON for the Middlesex County Council; and Mr. GABRIEL P. GOLDNEY (Remembrancer) for the Corporation of the City of London. The Southwark and Vauxhall Water Company are represented by Messrs. BIRCHAM AND CO.

Mr. *W. H. Dickinson*, in cross-examination by Lord R. CECIL, said the proposal of the County Council with regard to the outside areas, supposing purchase to have taken place, was to hand over the system of distribution and a proportionate share of the rights of drawing water according, roughly, to the population. The policy of the County Council was to give, as far as possible, the same rights as they claimed for themselves. Supplying in districts outside that of the County Council would be somewhat onerous on London; but it might be desirable that the Council should do it, if the Local Authorities wished.

Lord R. CECIL: Therefore Hertfordshire, you contemplate, would have to re-purchase from the London County Council a certain portion at any rate of the works?

Witness: Well, we have come to no agreement with Hertfordshire about it. I cannot say we contemplate anything in regard to Hertfordshire, because it is a very special case. You have very few consumers indeed of the Company's water—they are almost a negligible quantity. Witness went on to explain that it was not proposed to hand over to Hertfordshire any of the sources of supply in the county, save perhaps a well for their own supply. As to whether the London County Council would, when selling water in bulk, supply it at pressure or leave it to the Authority purchasing to pump it, this was a question which would have to be settled by the price paid. The Council would purchase the lines of pipes going into Hertfordshire, and the wells in the county; and it would be quite open to the Council, as it was now to the New River Company, to sink more wells and abstract more water. He believed that the Company had hitherto sunk wells in virtue of their position as landowners, not under any statute. The County Council, however, contested that they possessed such power. He knew there was a strong feeling in Hertfordshire that too much water was being drawn from the wells; but he could not pledge the Council to any limitation of the quantity they would take. If any hitch occurred in getting water from Wales, the Council would take it where they could get it—possibly from Hertfordshire, seeing that the Council did not wish to draw more water from the rivers. Under section 3 of the Act of 1897, the same privileges were given to Outside London as to Inside London, regarding power to demand constant supply, &c.; but he had not until now realized that it was so. It was very important, and he thought it was not contemplated when the Act was passed. If the Council became the purchasing authority the powers of control that should be applied to private companies should not be applied to them. If the outside Authorities stood by while the Council purchased the Company's undertakings, no doubt the Council would supply them afterwards with water.

Would you regard with favour a state of things in which the Herts County Council might be put in the position of compelling the London County Council to do their duty?—I do not think we should object. We should be put in the same position as Birmingham. If the Herts Council asked for a limitation of the right of taking water from Herts, they would have to pay for it, for the London County Council would have had to purchase the right from the New River Company. The price, on re-purchase, which Herts would have to pay, would depend on what the London County Council paid; and if it were ruinous or extravagant, the outside Authorities would still have to share it. I do not see why the outside Authorities should not be represented at the arbitration.

Therefore Hertfordshire would have to pay her proportion of the price, and something extra, if she proposed to limit the draft of water from Herts?—Yes. The re-sale to Hertfordshire would be on the basis of the County Council having a monopoly of the right to supply in Hertfordshire. I think the fears of Hertfordshire are greatly magnified, because the County Council do not think there is much more water to be obtained there. Proof of this is afforded by the fact that the New River Company have recently gone to the Thames for a further supply. Moreover, if the County Council thought much more was to be got from Herts, they would not be contemplating a Welsh scheme.

Can you tell me of any arguments for purchase which are not equally arguments for control except these—that the County Council has always been in favour of purchase as opposed to control, provincial examples, and finality?—I think every argument is for purchase. The matter might, however, depend on what the control was. The Council had never drawn up a scheme of control, nor appointed a Committee to consider the matter, because they thought no system of control could be effectual. Witness, however, did not say it was not possible to give more powers to the County Council to compel the Companies to carry out their duties properly.

The CHAIRMAN: The control hitherto has been a roundabout system of prosecution; but I suggest that there might be a sort of administrative control, by which the County Council or some other body should be in the position to say: "This must be done at once."

Mr. BALFOUR BROWNE: But you must have the money to do it. How if the Company replied: "We have no money to do it."

The CHAIRMAN: I am not expressing any opinion.

Major-General SCOTT (to Witness): I put it that if you mapped out the districts of the Companies, and had systematic investigations of the pressures, you would have an enormous amount of control over the whole supply of London?

Witness: I think we should. Anything that would enable the County Council to say: "This or that must be done," would be an immense advantage. Of course, the Companies would still have to go to Parliament for sanction to the expenditure.

In reply to Mr. MELLOR, witness said he thought that if the Companies were amalgamated, and a body put in authority over them, constituted after the manner of the Thames Conservancy Board (the different interests being represented according to population), the administrative grievances, the pressure, and so on, might be remedied. This would not be better than the scheme of purchase and re-sale to the different Authorities, because it would not be permanent. Supposing, for instance, it were clearly made out that water ought to be obtained from Wales, he doubted very much whether Parliament would give power to the County Council to order the Companies to do this at their own expense; whereas Parliament would grant such power to the Council. There would be no need to sever the works if the scheme were carried out on the lines of the big municipalities, where water was supplied at a fixed rate. Public sentiment—the desire of the people to have the water supply in their own hands—could not be disregarded.

By Mr. GOLDNEY: The Kent Company supplied no water outside their own county; and all their sources were in Kent. The London County Council would only, however, hand over to Kent the portion of the undertaking which was not within the Administrative County of London.

Mr. GOLDNEY, in answer to the CHAIRMAN, said the City Corporation were interested in the question of the purchase to the extent of one-eighth; and it was at least arguable whether the Kent Company should be bought at all.

Witness was then questioned with a view to showing that purchase would result in an increase of rates in the City, where special terms had been made with the New River Company. He said, however, that an arrangement similar to that in force in Liverpool would probably be made, by which there would be a special charge for "lock-ups."

Mr. GOLDNEY, replying to a further question from the CHAIRMAN, said the City had for many years been in favour of absolute control of the Water Companies by representatives of the public, either by purchase or administrative control. They had always pointed out the extreme difficulty of charging by any public authority, if they purchased, because of the inequality of the local circumstances and of the cost of water. He wanted it to be clear that the City wished to emphasize these points, and had never departed from them; and further that, having regard to the extremely high rating of the City, mere rateable value ought not to be the basis of charge.

Sir *John Lubbock*, Bart., M.P., examined by the CHAIRMAN, said he was a member of the Water Committee of the County Council, and had served on Committees of the House of Commons engaged on Water Bills. He was of opinion that purchase in London was inexpedient, because there would then be no body, as now, to watch over the purity of the water; and if the County Council were the Authority, the administration of the concerns would interfere with their other work, even if they only had to care for the supply of London. He could not say that the Government inspection would cease; but if the Council had the supply, they would not be in so effective a position to take action, in case of impurity. As to the financial results of purchase, he stated that the Comptroller of the Council gave the present market values of the Water Companies' stocks as £39,615,000. The Comptroller calculated that the money could be raised at £2 12s. per cent., at which rate the sum required to provide interest and sinking fund per million pounds, assuming a period of 80 years for each, would be £30,026. The £39,615,000 would therefore entail an annual payment of £1,190,000, allowing nothing for compulsory sale—which Parliament was hardly likely to permit. This would leave a net yearly loss on the average income of the Companies for the last seven years of £40,000. The saving of £50,000 which the Comptroller assumed, witness thought to be very hypothetical and unlikely. Further, in raising so large a sum of money, the County Council, he believed, would have to pay something beyond the £2 12s. per cent.; and if this extra were only ¼ per cent., it would mean £100,000 a year. Then if the adjoining districts were to have their own supply, there would be considerable expense in re-arranging the mains, even if this involved no engineering difficulty. More important than any of these things was the information of the advisers of the County Council, that they must go to Wales or largely increase the storage in the Thames Valley, either of which courses would entail heavy expenditure. As far as the further supply was required by the growth of the population, there would be an increase of income; but if the intention was to supplement or replace the existing supplies from the Thames and Lea Valleys, the expense would fall on the ratepayers without any additional income to meet it. He was strongly of opinion that, if purchase took place, there would be an increase in the rates. He should not put the figure so high as 30 per cent., as formerly calculated by Mr. Dickinson; but it would be substantial. As to charging on the basis of rateable value, he agreed that it was not just that the charge of a Company for the same quantity of water should be increased by the action of an Assessment Committee. Questioned regarding the instances of Provincial purchase, he said that what was a guide in one place was hardly so in another. In London, there was the special fact that so large a proportion of the capital was receiving its maximum dividend. Thus, in the case of the West Middlesex Company, any larger profit that they made would go to benefit the ratepayers. This applied also to several other Companies. Municipal management had many advantages; but he did not know that economy was generally one of them. It was also undesirable that municipalities should be large employers of labour, especially in cases where the people employed elected those who employed them. The two main grounds of opposition to purchase were: First, that there was a greater guarantee for the purity of the water now that the County Council kept an eye on the Companies, than there would be were the Council the authority; and, secondly, there was the great prospective expenditure which, under existing conditions, would fall on the Companies, but which if purchase

took place would come upon the ratepayers. The tendency of feeling now was more in favour of control than of purchase. There were many, he thought, who were waiting the result of the present Commission's deliberations from the financial point of view, because there had never been really an inquiry as to whether purchase was desirable or not. His objections to purchase by a Trust would be nearly the same as to purchase by the County Council. He was in favour of control. The shareholders in the case (say) of the West Middlesex Company, were in the position somewhat of preference shareholders; the ratepayers standing in the position of ordinary shareholders, for they were the persons who would benefit by any improvement in management or income. They had a substantial interest in the concern; and he therefore suggested that one or more representatives might be appointed to look after this interest. It might be best that the representatives should be nominated by the Local Authorities. With regard to back-dividends, he held that, as the final settlement of the water question would save not merely the ratepayers, but also the consumers, heavy legal expenses, it might be well to ask the Companies to agree to some limit; and he thought they would be willing to acquiesce in such a proposal. As to depriving the Companies of any benefit arising from increase in rateable value, he agreed that in the case of those who had not reached their maximum dividends, the matter was serious. The principal instance was that of the Southwark and Vauxhall Company; and here the County Council thought the present dividend would not be maintained, which witness held to be a strong reason for not buying the concern at all. In regard to the New River Company, where there was no limit to the dividends, an arrangement might be made regulating the dividends, perhaps to what they were now.

Mr. De Bock Porter: Do you think if control is to be a permanent settlement, you can have differential rates over London?

Witness: You have differential rents.

Parliament has gone in the direction of the equalization of rates?—Well, I cannot exactly see why you should equalize some things and not others.

By Sir J. Dorington: If the Companies were left alone, the extra supply that would shortly be needed might be brought from a distance by the County Council and sold to the Companies. Or one Company might undertake the work on behalf of the others; or, again, the Companies might amalgamate to do it.

By Mr. De Bock Porter; If a system of control were established, he should think the sinking fund clauses might be abandoned, for there would then be little good in maintaining them.

Mr. De Bock Porter: At present the sinking fund payments are only increasing the price of water in the West Middlesex district?

Witness: Yes; they are small at present, but they go on increasing.

By Mr. Cripps: The fact that it was necessary to go to Wales almost immediately, strengthened the argument against purchase very much. He should, however, have been opposed to purchase even if this expenditure had not been imminent.

The Commission then adjourned till yesterday, the 21st inst.

The sixteenth sitting of the Commission was held yesterday, at the Westminster Town Hall—Lord Llandaff presiding. Sir John Lubbock, whose examination-in-chief was concluded at the last sitting, was now questioned by various members of the Committee. In reply to Major-General Scott, he expressed the opinion that it was not necessary to have more control over the Water Companies in regard to making provision for the future; indeed, he thought they would be more likely to attend to this duty than a local authority, seeing that, in case of failure, they would suffer heavily in their dividends, while the local authority, supposing the undertakings to have been purchased, would incur no such penalty.

DOUGLAS (ISLE OF MAN) WATER SUPPLY.

Mr. G. H. Hill's Scheme.

An important report by Mr. G. H. Hill, M.Inst.C.E., in which he gives particulars of a scheme of increased water supply which he has devised for the town of Douglas (Isle of Man), has been distributed among the members of the Water Committee of the Corporation. The last reservoir of the old Water Company, which has a capacity of about 25 million gallons, was completed about five years ago. When Mr. Hill reported upon the water supply in 1888, he estimated that the requirements in the summer months would be 700,000 gallons per day, and that in the present year 900,000 gallons per day would be wanted. In 1896 the reported consumption was over a million gallons per day, showing a consumption of 25 gallons per day on an average summer population of about 40,000, and an increase during the eight years of 5½ per cent. On this basis he calculated that the consumption in four years would reach nearly 1¼ million gallons per day; and in fifteen years—the shortest time for which new works should be provided—1¾ millions, excluding the water pumped from Groudle River. The then available supply was 750,000 gallons per day; and as the further works for increased supply could not be constructed in less than four years from then, he estimated that by the time the works were available the requirements of the town would be at least 1¼ million gallons per day. His opinion was that the new works were urgently needed, and that to provide for the future a new reservoir should be constructed to give a supply of at least a million gallons per day, in addition to the supply from the present Groudle works. Mr. Hill's present report recommends a new reservoir in West Baldwin, at a point lower down the river than Ingebreck, having an area of about 25 acres, and to contain 300 million gallons. The reservoir must be this size if compensation water is to be provided for mill works on Douglas River, and the cost will be £50,000. But if compensation is given in money instead of water, a reservoir with a capacity for 180 million gallons will be sufficient, and will cost about £8000 less. The supply from the larger reservoir, after allowing ample for water compensation, will be 1½ million gallons per day, which, added to the present gravitation supply, will give a total supply of 2¼ million gallons per day. The cost means an addition of 4d. in the pound to the rates; but 1d. of this will be recouped by the saving in the cost of the pumping-station at Groudle, and the sale of the property there.

PORTSMOUTH CORPORATION AND THE WATER COMPANY.

The Protection of the Sources of Water Supply.

A Special Meeting of the Portsmouth Corporation was held last Tuesday, to consider the letter received from the Directors of the Water Company and the report of the Water Committee referred to in the "Journal" last week (p. 612). Alderman T. Scott Foster moved the adoption of the report. Referring to the outlay incurred by the Company with the view of protecting their sources of supply, he said that, as the result of the expression of public opinion and the reports made by Dr. Thomson and Mr. Whitaker, the Directors had carried out improvements, and had shown that they were prepared to take such steps as would prevent any suggestion that the question of the purity of the water supply of the borough would be neglected. The Committee felt that the supply would be properly safeguarded, and that they could sit down satisfied that no further danger existed. Mr. Dittman thought there was no great hurry in the matter. He moved, as an amendment, that the report should be sent back to the Committee to report as to the exact amount of money the Company were going to spend to give effect to the recommendations, and whether some of their charges could not be reduced. Mr. Brewis opposed the amendment; saying that it was of first importance that immediate steps should be taken to safeguard the springs from pollution. Alderman Scott Foster, in reply, said he believed the Company intended to acquire all the land they could that was necessary to prevent contamination of the water supply; and it would be taking a most illogical course to object to the Directors obtaining money to carry out what the Council had demanded. He held that the charges referred to by Mr. Dittman were vexatious and obnoxious; but that matter had nothing to do with the question in hand. The amendment was lost by 7 votes to 31; and the report was adopted. Alderman Scott Foster then moved the adoption of a recommendation by the Water Committee that a memorial should be sent to the Local Government Board supporting the Water Company's application for an inquiry to be held in regard to the necessity of Havant being drained; and if this necessity should be shown to exist, that the Board should be asked to take the requisite steps for ensuring the drainage of Havant. A desire was expressed to hold the matter over till the next meeting of the Council, as it was said to be the intention of the Havant District Council to ask that a deputation might attend to state their case. Alderman Scott Foster pointed out that the memorial could be supported generally without the details being subscribed to; whereupon the recommendation was adopted.

LEAMINGTON CORPORATION WATER SUPPLY.

Additional Works and Supply—The Advantages of Gas-Engines for Pumping Purposes.

In the "Journal" for Sept. 29, 1896, we referred to an application by the Leamington Corporation for the sanction of the Local Government Board to a loan for the purpose of sinking a new well. At first the Board refused unless an experimental borehole was made; but subsequently they granted their sanction in the following terms: That if in sinking the well the Corporation met with success, a loan for the cost of the whole of the works requisite would be granted for a long term; but that if failure attended their efforts, the loan for the cost of the well would be limited to a period of five years. The Borough Surveyor (Mr. W. de Normanville) has now the satisfaction of reporting to the Water Committee that the work has been successful; the total yield having reached 430,000 gallons per day, or 30,000 gallons per day more than the quantity stipulated for in his specification. As the analysis of the water was also thoroughly favourable, the Corporation are in a position to satisfy the requirements of the Local Government Board. The cost of the work up to the present time has been £2340—£1527 being the cost of the well and headings, and £813 that of pumping water during the operations. The well is 170 feet deep; and there are two headings, aggregating between them 200 feet in length. Seven 4-inch bores have been put down from the floors of the headings to the bottom of the water-bearing stone, which is some 27 feet below. Regarding permanent plant for the well, he recommends that pumps should be put down of a capacity of 500,000 gallons per day. For motive power, he suggests either a gas or an oil engine, preferably the former, but both of which he says have many advantages, as compared with steam. In first cost the expense of boiler, boiler-house, and smoke stack is saved—say, in this case, £500. In working, the stoker's wages, about 25s. per week, are saved. In fuel, the cost is less than that of coal; and the weight of fuel to be carted from the railway to the works is, if oil be used, about one quarter that of coal, and in the case of gas, *nil*. There is the further economic advantage of there being neither repairs nor renewal of boiler. The chief advantage, however, is that gas and oil engines can be put to work at any time in about ten minutes; whereas from the time of lighting fires in an ordinary steam-boiler, some 20 hours should be allowed for gradual heating. The Council yesterday week decided to apply to the Local Government Board for sanction to the borrowing of £5000 to carry out the work mentioned in the report.

Reading Water-Works.—At the Abbey Hall, Reading, before the Ratepayers' Association, a short time since, a paper on "The Reading Water-Works" was read by Mr. A. T. Walker, the Manager of the works. Mr. Walker sketched the history of the water supply of the town since 1694, when, he said, an "undertaking was planned" to supply the place; an agreement being entered into by the Corporation to grant to a small Company the sole right "to supply the town with water for one thousand years." Having dealt with the earlier cisterns and pumping machinery used, Mr. Walker pointed out that the Company obtained their first Act of Parliament in 1826. He then proceeded to speak of the gradual extension of the supply and the improvements made from time to time. The works were acquired by the Corporation in 1868; and in 1878 the Fobney works were constructed. These, and improvements effected in 1890 and 1892, were described in detail; the lecturer remarking that the quantity of water passing the works daily was upwards of 50 million gallons, from 30 to 35 millions of which were used for power.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Before these "Notes" appear in print, I expect that we shall know the fate, in the House of Lords, of the Edinburgh and Leith Gas Bill, and probably of the Stirling Gas Company's Bill too. I therefore need say little about the measures, because the circumstances may change before what I write could be read. As to the Edinburgh Bill, there is nothing to remark except that it is being opposed by a very small interest. With regard to the Stirling Bill, there is this to be said, that at a meeting of the Police Commission a week ago a long correspondence between the Law Agents of the Gas Company and of the Commissioners was submitted. The letters disclose a desire on the part of the Company to come to friendly terms before going to London, even to the length of enumerating the subjects upon which they offered—without prejudice, of course—to modify their Bill. On the part of the Committee representing the Commissioners, there was always the halting excuse that, until their petition against the Bill was lodged, they could not negotiate; and then, when the petition was lodged, there came from them the offer to hold a conference. But only 48 hours' notice was given. The Commissioners approved the action of their Committee, a portion of which was a suggestion for a meeting between the parties in London, with a view to coming to terms. I observe a comment in a Stirling newspaper, which is interesting. It is to the effect that Mr. Hepworth, of Edinburgh, who is to be a witness for the Company, has made various openings in the thoroughfares and inspected the mains belonging to the Company. Mr. Hepworth's evidence, the writer considers, should have more weight than that of the workmen the Commissioners are to put forward.

The Edinburgh and Leith Gas Commission held their statutory annual meeting on Monday. As a matter of fact, there was nothing annual about it, and could not be, for there is nothing of an annual nature which happens about this time; and the Commissioners therefore converted it into their customary monthly meeting for March. It was a small meeting; there being so many of the leading members in London in connection with the Commissioners' Bill. The business before the meeting was also small. The only item in which readers of the "JOURNAL" take an interest was a speech by Mr. John Jamieson, which, I think, would have been better left unspoken. He said the Engineer's report showed that there had been a decrease in the output of gas from the Edinburgh works during February of about 1¼ million cubic feet, as compared with the same month of last year; while at Leith there had been a slight increase, and in Portobello an increase of fully a million cubic feet. So far as Portobello was concerned, he thought the result proved that there was always a large rise in the consumption of gas after a reduction in price. As regarded Edinburgh he believed the report pointed to this, that the electric light, of which there had been a very large extension recently, was beginning to tell on their business. They had not had a reduction in price in Edinburgh for nearly three years; and he supposed that, but for the natural increase of the city, they might take it that they had reached a point where their output was stationary. It should therefore be their endeavour to get a further reduction in price. The quantity of gas produced per ton of coal continued to improve; their wages bill was lower; and in every way the management of the works appeared to be efficient. What I feel disposed to find fault with in these remarks is not the facing-up of the situation, which, in Mr. Jamieson's opinion, has arisen, but in unduly magnifying the effect of the electric light upon their business. It goes without saying that, but for the electric light, the Commissioners would sell more gas. That is so patent that it needed no comment. But the electric light is not the only, nor do I believe the principal, cause for the decrease in Edinburgh. The exceptionally good weather of the past winter has more to do with the decrease than anything else. No person living has ever seen a season like this. Snow has been almost unknown; there has never been more than a few degrees of frost, and that very rarely; and as for sunshine, it has been exceedingly plentiful. There has thus been less gas required, both for lighting and heating. As to the slight increase in Leith, it has to be remembered that the north side of Edinburgh is supplied from Leith; and in this district there has been a very great extension, both of works and dwellings. Then, again, the suggestion that a reduction in the price of gas was desirable was out of place, considering that the Commissioners are about to face a very large capital outlay upon new works. If they can carry the scheme through without requiring to raise the price of gas they should be pleased; and, if they do it they will have to thank the management of Mr. Herring, which it was proper to acknowledge.

Mr. Hubert Pooley, the Manager of the Dunfermline Gas-Works, has applied his ingenuity to the ascertainment of the correct wages paid to labourers in gas-works, in a way which may be useful to others. The men in his employ asked to have their working hours reduced from 60 to 51 hours per week, and to have their present weekly wages of 21s. retained, with an allowance of time-and-a-half for overtime during the week, and double time for Sunday work. Mr. Pooley obtained, and submitted to his Committee figures showing the work and pay in all the gas-works in Scotland having an output of between 50 and 100 million cubic feet per annum. From these, it appeared that the average number of hours worked is 57·85; and that the wages paid are 4·28d. per hour, or 20s. 10·39d. per week, and for overtime 4·42d., and Sunday work 4·97d. per hour. The Committee agreed to reduce the hours to 54, and to make the wages 4½d. per hour, which is equivalent to 21s. per week, and to retain the pay for overtime both for week-days and Sundays at 5d. per hour. This was adopted by the Commissioners at their meeting on Monday. At the same meeting, Mr. Pooley reported an increased output of gas during the past month of 1,180,600 cubic feet, which is equal to 13·36 per cent. This pleasant piece of information must yet be somewhat troublesome to some who were on the Corporation side at the time of the transfer, and who, in their evidence, endeavoured to make out that Dunfermline was a back-going town, in which the consumption of gas was more likely to decrease than to increase. However, "all's well that ends well;" and it would have been more uncomfortable for all concerned had the fears of these gentlemen been realized. Of course, such a large increase in the output cannot go on for long without an enlargement of the works; and the Commissioners quite properly had the subject before them. Mr. Pooley submitted two schemes of extension; and one of these they adopted, I am glad to be able to say, without dissension. This provides for the duplication of the exhausting plant, at a cost of £470; the expenditure of £546 in the division of the area of supply into two zones, to enable the pressure to be reduced, with a view to lessening the unaccounted-for gas; and the laying of new mains, at a cost of £256. In some towns there would have been months of discussion before an expenditure like this was sanctioned. The Gas Commissioners of Dunfermline go about their work in a business-like manner; but, of course, they have nobody among them who loves to make demonstrations for popularity purposes. Mr. Pooley's report on the present condition and the future requirements of the works was circulated among the Commissioners, everyone being thus able to satisfy himself, at his leisure, as to the requirements of the undertaking; and this procedure, together with the unanswerable statements in the report, enabled a unanimous decision to be arrived at. Happy is the gas manager whose lines have fallen in such pleasant places as have Mr. Pooley's.

The Peebles Gas Company was registered in Edinburgh this week as a limited liability Company, under the name of the Peebles Gaslight Company, Limited. The capital is £6000, in £5 shares. As I have said on other occasions, I think the word "Light" should be dropped out of the name of gas companies nowadays, when so much gas is sold for other than illuminating purposes. Of course, the objects of the Company will be accurately described in the Memorandum of Association; but, all the same, it is a pity to assume a name which does not quite accurately convey what is the object of the undertaking.

At a meeting of the Troon Police Commissioners on Monday, a letter was read from the Secretary of the Troon Gas Company stating that the Company had decided to sell their works and plant to the town, and further intimating that they had appointed Mr. W. Fairweather, of Kilmarnock, as their valuator. The Commissioners have retained the services of Mr. J. M'Gilchrist, of Dumbarton, to act in the same capacity for them.

The Burgh Commissioners of Darvel, in Ayrshire, have been for some time in negotiation with the Darvel Gas Company, with a view to acquiring their undertaking. This has now been successfully accomplished. The price to be paid by the Commissioners is 25s. per share; the transfer to take place on June 1 next. The Company have paid dividends at the rate of 7½ per cent. for years.

A Sub-Committee of the Greenock Police Board on the reduction of gas consumption in public lamps, reported to the Board on Tuesday that, having made inquiry into the lighting of the streets in Liverpool, where the consumption of gas is reduced at midnight according to a method introduced by Mr. Bellamy, Superintendent of Lighting, and having considered the feasibility of adopting the same principle in Greenock, they cannot see their way to recommend that any reduction can be made on the lighting of the public lamps at and after midnight—particularly in view of the fact that by far the largest number of the street-lamps in Greenock are rated to consume only 2 feet per hour.

Mr. J. M'Gilchrist, of Dumbarton, has prepared a most exhaustive and careful report, for the Gas Commissioners of North Berwick, relative to the proposed removal of the works to a new site. He reports that the policy of patching the present gas-works is a most extravagant one. It would be necessary, in the event of new works not being erected, to extend the present ones; but this would only tide them over a few years. If the present rate of increase be continued, the output will be doubled in about nine years. Last winter all the retorts were at work; and if a stoppage in the manufacture of gas for three hours had taken place or their old holder had given way—and he was astonished that it had held together—the place would have been in darkness. He recommended one of two sites which had been looked at, containing 2·8 acres, contiguous to the railway, and being sufficiently large to accommodate electric-lighting plant. This would enable gas and electric light to be provided under one management, and so reduce the cost of both. To complete the new works, and make them equal to an output of 20 million cubic feet per annum—the present output is about 12 million feet—would, he estimates, cost £10,000; and if £4000 were obtained for the old works, the Commissioners would only require to raise £6000. The economy in manufacturing gas by the regenerative process, giving 10,000 cubic feet per ton of coal instead of 7000 cubic feet, would alone provide a sum equal to the amount required to pay the interest and sinking fund; and with new works and increased consumption, gas might be sold at 3s. 4d. per 1000 cubic feet. The Commissioners spoke approvingly of the report, and appointed a Committee to inquire after the site, and look into the subject of electric lighting.

Mr. W. Brownlee, who was at one time Convener of the Works Committee of the Dundee Gas Commission, has written a letter to the "Dundee Advertiser," in which he endeavours to controvert the statements of the article upon the Glasgow Gas-Works to which I referred recently. He makes out that, for the providing of ground at a cost of £20,000, the enclosing of the ground, and the provision of plant, the total outlay would be at least £50,000, the interest and sinking fund upon which would, at 5 per cent., amount to £2500 a year; and that the whole of the estimated saving in labour, with the exception of £72, would be required to meet the expenditure necessary to effect a saving of £2572. I think he is in error; but his attitude is another illustration of the difficulty there is in getting public men in Dundee to consent to spend money upon public works.

The old gas-works in Dunfermline are nearly removed; the retort-houses being almost entirely taken down, though some heavy material may be on the ground for a month or two. The removal of the works from the centre of the town has effected a very great improvement.

The Secretary of the Stranraer Gas Company has written, in reply to the resolution adopted in the Town Council recently regarding the quality of the gas sent out by the Company, that the Directors had always been desirous of supplying good gas, so far as in their power; and that they had never grudged spending money on improvements. With special reference to the general complaint as to the quality of the gas for two or three days at the beginning of last month, he stated that one of the purifiers was allowed to run foul for a time, which reduced the illuminating power, and gave rise to the offensive smell. The Directors were willing that any member of the Council should examine the coal in their yard; and the Secretary was prepared to show the receipts for the coal. The Directors were anxious to satisfy the public, so as to retain their customers. They were aware of the statutory power of the Council to have the gas tested, and were willing to pay one-half the cost of the testing

apparatus, and to give every facility of access for the purpose. The letter was submitted to the Town Council at a meeting on Tuesday, and was sent to the Lighting Committee. The proceedings appear to be very friendly; I hope they will continue so.

The financial report of the Aberdeen Corporation Electricity Department shows a surplus of £169 for the past year. It is calculated that it would have been £300 more, if it had not been for the cost incurred in the arrangements for doubling the pressure. The capital expenditure has been £48,423, of which £11,802 was expended last year.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *March* 19.

Sulphate of Ammonia.—There has been no break in the downward movement; and closing quotations are £8 18s. 9d. to £9 per ton f.o.b. at the ports. Direct orders have been scarce; and the bulk of the buying has been done by middlemen to cover sales previously made. While shipments to Spain have been all along exceptionally heavy, those to other points have been disappointing. Probably the prices reached in January brought nitrate of soda into successful competition both in the United States and on the Continent; but present prices place the two articles on the same level, *per unit;* and there is therefore no longer reason for reversion to nitrate of soda. No doubt, too, buyers were at the end of January well supplied; but quantities in consumers' hands must now be much reduced. Meantime makers have become rather tired of waiting, and are showing more anxiety to be making sales. Home demand is fairly good; but heavy consumption has not yet set in; and in a falling market, buyers are postponing their purchasing to the last moment. There is forward speculative offering at a discount on spot prices; but it does not attract much attention.

Nitrate of Soda.—Deliveries of nitrate of soda continue to be satisfactory; but the spot price of fine quality remains at 7s. 6d. per cwt.

LONDON, *March* 19.

Tar Products.—Benzols are flat, with a downward tendency. The large accession from coke-ovens is doubtless the cause of the present weakness. Fortunately, makers in this country have no stocks, and are mostly well sold. Solvent naphtha, as well as heavy naphtha, are in fair request. Carbolic acid is also inquired after, and a large business is reported for summer delivery. Creosote continues firm and scarce; but the low price of petroleum oils will probably prevent further advances in this article. Already the higher prices of creosote have brought large quantities of petroleum into competition with it for certain purposes. Anthracene is moving freely; and the value is well maintained. But, doubtless, the exceptionally low price now quoted for it is attracting buyers, as well as largely decreasing production.

The average prices for the week are: Tar, 12s. to 15s. Pitch, east coast, 19s. 6d.; west coast, 15s. to 16s. Benzols, 90's, 1s. 3d.; 50's, 1s. 5½d. Toluol, 1s. 9d. Solvent naphtha, 1s. 6½d. Heavy naphtha, 1s. 3d. Crude, 30 per cent., naphtha, 6½d. Creosote, 2½d.; liquid, 2¾d. Heavy oils, nominal, 42s. 6d. Carbolic acid, 60's, 2s. Naphthalene, 50s.; salts, 30s. Anthracene, "A," 5½d.; "B," 4½d.

Sulphate of Ammonia.—This product is still on the down-grade; and sales have been made at £9, less 3½ per cent., which may be taken as to-day's value in all positions.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—A general slackening off in the demand for all descriptions of house-fire coal has been reported during the past week; and though pits are still mostly kept on full time, with the output moving away, the production has been ample to meet requirements, without resort to stocks. Quoted list rates remain unchanged; but the general tone of prices is not quite so firm. Though the position is scarcely so unsatisfactory as the outlook a month back indicated, the prospect for the ensuing summer is anything but encouraging from the coal-owner's point of view; and there would seem to be every probability that for gas coals prices will again rule excessively low. Common qualities of round coal, though in fairly good request, as a result of the general activity throughout the district, are still plentiful on the market, and continue extremely low in price. In fact, all descriptions of round coal are in excess of requirements; and at the pit the average prices per ton may be quoted about as follows: Best Wigan Arley, 10s. to 10s. 6d.; Pemberton four-feet and seconds Arley, 8s. 6d. to 9s.; common house coal, 7s.; and ordinary steam and forge coal, 6s. to 6s. 6d. Engine classes of fuel move off fairly well; the restricted demand for round coals keeping down the output of slack. At many collieries supplies are short; but in the open market the quantities offering are ample for all requirements, and prices are not more than maintained at late rates. Best qualities only in exceptional cases fetch more than 4s. 3d. to 4s. 6d. per ton; medium 3s. 9d. to 4s.; and common sorts, 3s. to 3s. 6d. In the shipping trade, not more than a moderate business is being put through; and with plentiful supplies of common coal, buyers can place orders for prompt clearance at very low figures. Common steam coal is readily obtainable at 7s. 6d. to 7s. 9d., with better qualities quoted 8s. to 8s. 6d., at Mersey ports.

Northern Coal Trade.—There has been a decided increase in the demand for coal through the critical nature of the Welsh miners' dispute influencing purchases here. The chief increase has been in steam coals, which have risen to 8s. 3d. per ton f.o.b., for prompt delivery, and which are now quoted at higher forward prices, especially for best Northumbrian steam coals. Small coals have risen to 3s. 3d. per ton, and are now somewhat scarce. In the manufacturing coal trade, there is rather a better demand also; but the prices show no alteration. In gas coals interest has centred in the result of the Rotterdam gas-coal contract competition, in which Durham coals compete with German. The prices are now known, and are from 4d. to 8d. per ton above those of the past year; but as the quotation includes freight, &c., and is influenced by the cost of lighterage, it may be sufficient to say that the yield to the coal-owners here is

GAS AND WATER COMPANIES STOCK AND SHARE LIST.

Referred to on p. 640.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 14	10½	Alliance & Dublin 10 p. c.	24—25	−1	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	16½—17½	..	4 5 8
300,000	100	Jan. 3	5	Australian 5 p. c. Db.	105—107	..	4 13 6
200,000	5	Nov. 11	6½	Bombay, Ltd.	5¾—6¼	−¼	5 4 0
40,000	5	,,	6½	Do. New, £4 paid	4¾—5¼	−¼	4 19 1
380,000	Stk.	Feb. 24	12	Brentford Consolidated	295—300	..	4 0 0
240,000	,,	,,	9	Do. New	228—233	..	3 17 3
50,000	,,	,,	5	Do. 5 p. c. Prf.	142—147	−3	3 8 0
159,375	,,	Dec. 15	4	Do. 4 p. c. Db. Stk.	134—138	..	2 18 0
220,000	Stk.	Sep. 15	11½	Brighton & Hove Orig.	975—985	..	4 2 3
218,820	,,	,,	8½	Do. A. Ord. Stk.	200—205	..	4 2 11
933,500	Stk.	Feb. 24	5	Bristol, 5 p. c. max.	127—132	−3	3 15 9
420,000	20	Sep. 30	11½	British	56—57	..	3 19 0
50,000	10	Mar. 11	11½	Bromley, Ord. 10 p. c.	25—27*	..	4 5 2
75,000	10	,,	8½	Do. 7 p. c.	20—22*	..	3 17 3
500,000	10	Oct. 14	6	Buenos Ayres (New) Ltd	9½—10	−¼	6 0 0
98,122	Stk.	Dec. 30	4	Do. 4 p. c. Db. Stk.	98—100	+1	4 0 0
150,000	20	Mar. 11	8½	Cagliari, Ltd.	30—31*	..	5 6 5
100,000	10	Sep. 30	8	Cape Town & Dis., Ltd.	17—18	..	4 8 11
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	59—61	..	4 18 5
550,000	Stk.	Oct 14	13½	Commercial Old Stock	340—345	..	3 18 3
200,750	,,	,,	10½	Do. New do.	255—26C	..	4 0 9
200,750	,,	Dec. 15	4½	Do. 4½ p. c. Db. dc.	154—157	..	2 17 4
800,000	Stk.	Dec. 15	12	Continental Union, Ltd.	225—235	..	5 2 2
200,000	,,	,,	9	Do. 7 p. c. Prf.	208—213	..	4 4 6
51,600	Stk	Feb. 24	14	Croydon A 10 p. c.	310—315	..	4 8 11
168,400	,,	,,	11	Do. B 7 p. c.	255—265	..	4 3 0
535,000	Stk.	Feb. 24	5½	Crystal Palace Ord. 5 p. c.	130—135	−3	3 17 9
60,000	,,	,,	5	Do. 5 p. c. Prf.	140—143	..	3 9 11
486,090	10	Jan. 27	11	European, Ltd.	25—26	..	4 4 7
354,060	10	,,	11	Do. £7 10s. paid	17½—18½	..	4 9 3
5,922,110	Stk.	Feb. 10	12½	Gaslight & Coke, A, Ord.	293—296	..	4 5 6
100,000	,,	,,	4	Do. B, 4 p. c. max.	120—125	..	3 4 0
665,000	,,	,,	10	Do. C, D, E, 10 p. c. Prf.	310—315	−5	3 3 6
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	150—155	..	3 4 6
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	220—225	..	3 6 8
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	195—200	−4½	3 10 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	310—315	−3	3 3 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	183—188	−2	3 3 10
1,061,150	,,	Dec. 15	4	Do. 4 p. c. Db. Stk.	133—136	−4	2 18 10
294,850	,,	,,	4½	Do. 4½ p. c. do.	150—155	−5	2 18 1
958,000	,,	,,	6	Do. 6 p. c. do.	202—207	−3	2 18 0
70,000	10	Oct. 28	8	Hongkong & China, Ltd.	14—15	..	5 6 8
3,800,000	Stk.	Nov. 11	10	Imperial Continental	212—217	..	4 12 2
376,400	100	Feb. 1	4	Do. 4 p. c. Dbs. Red.	98—101	..	3 19 3
473,600	Stk.	Feb. 10	3½	Do. 3½ p. c. Db. Stk.	103—106	..	3 6 0
				* Ex div.			

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
75,000	5	Dec. 15	6	Malta & Medn., Ltd.	5½—6	..	5 0 0
560,000	100	Oct. 1	5	Met. of Mel- bourne 5 p. c. Db. 4½ p. c. Db.	113—114	..	4 7 8
250,000	100	,,	4½		109—111	..	4 1 1
541,920	20	Nov. 11	5	Monte Video, Ltd.	15½—16½	..	6 1 3
150,000	5	Nov. 26	8	Oriental, Ltd.	8—8½	..	4 14 2
135,000	5	,,	8	Do. New, £4 10s. pd.	7—7½	..	4 16 0
15,000	5	,,	8	Do. do. 1879, £1 pd.	1½—2	..	4 0 0
60,000	5	Mar. 11	7	Ottoman, Ltd.	4½—5*	..	7 0 0
420,000	100	Nov. 2	6	People's Gas 1st M. Bd.	104—109	..	5 10 1
500,000	100	Dec. 1	6	of Chicago 2nd do.	103—108	..	5 11 1
250,000	10	Sep. 30	10	San Paulo, Ltd.	16—17	..	5 17 3
135,000	Stk.	—	10	Sheffield A.	250—253	..	3 19 0
209,053	,,	—	10	Do. B.	250—253	..	3 19 0
447,427	,,	—	10	Do. C.	250—253	..	3 19 0
5,531,250	Stk.	Feb. 24	5½	South Metrop., 4 p. c. Ord	137—140	..	3 15 0
1,460,000	,,	Jan. 13	3	Do. 3 p. c. Db. Stk.	104—107	−1	2 16 1
60,000	Stk.	Mar. 11	12	Tottenham and A. Edmonton B.	285—295*	..	4 1 4
60,000	,,	,,	9		205—215*	..	4 3 9
182,380	10	Dec. 20	7	Tuscan, Ltd.	13½—14½	..	4 16 7
149,900	10	Jan. 3	5	Do. 5 p. c. Dbs. Red.	100—103	..	4 17 1
				WATER COMPANIES.			
746,164	Stk.	Dec. 30	10½	Chelsea, Ord.	333—338	−2	3 2 2
150,000	,,	,,	5	Do. 5 p. c. Prf.	177—180	..	2 15 6
160,000	,,	,,	4½	Do. 4½ p. c. Pf. Stk., 1875	157—160	..	2 16 3
175,785	,,	Sep. 30	4½	Do. 4½ p. c. 1 b. Stk.	160—165	..	2 14 6
1,720,560	Stk.	Oct. 14	7½	East London, Ord.	224—229	..	3 5 6
654,740	,,	Dec. 30	4½	Do. 4½ p. c. Db. Stk.	161—164	..	2 14 11
390,000	,,	,,	3	Do. 3 p. c. Db. Stk.	105—107	..	2 16 1
700,000	50	Dec. 15	7½	G'd Junct'n, 10 p. c. max.	120—125	..	3 0 0
295,000	Stk.	,,	4	Do. 4 p. c. Db. Stk.	147—152	..	2 12 8
708,000	Stk.	Feb. 10	13	Kent	358—363	..	3 11 8
160,000	,,	,,	7	Do. New, 7 p. c. max.	213—218	..	3 4 3
1,043,800	100	Dec. 30	10	Lambeth, 10 p. c. max.	298—303	..	3 6 0
406,200	100	,,	7½	Do. 7½ p. c. max.	230—235	..	3 3 10
350,000	Stk.	Sep. 30	4	Do. 4 p. c. Db. Stk.	147—150	..	2 13 4
500,000	100	Feb. 10	13	New River, New Shares	445—450	..	2 17 10
1,000,000	Stk.	Jan. 27	4	Do. 4 p. c. Db. Stk.	147—152	..	2 12 8
902,300	Stk.	Dec. 15	6	Southw'k & V'xhall, Ord.	155—160	..	3 15 0
126,500	100	,,	6	Do. do. 7½ p. c. max.	160—165	..	3 12 9
489,200	Stk.	,,	5	Do. do. 5 p. c. Prf.	174—179	−1	2 15 10
1,019,585	,,	Oct. 14	4	Do. 4 p. c. A Db. Stk.	146—149	..	2 13 8
1,155,066	Stk.	Dec. 15	10	West Middlesex	310—315	−3	3 3 6
200,000	,,	,,	4½	Do. 4½ p. c. Db. Stk.	162—165	..	2 14 7
				* Ex div.			

expected to be 7s. to 7s. 4d. per ton f.o.b. There is now a decreased consumption of gas coals in the home market so that collieries are beginning to work shorter time. Gas coke is unaltered this week. The distribution of the Rotterdam contract is the same as last year—two-thirds to Durham, one-third to German pits; the total being 72,000 tons.

Scotch Coal Trade.—No change can be reported, either as to demand or value, except that for splint the price is slightly easier. There is a plentiful supply of all sorts. The prices quoted are: Main, 6s. 6d. per ton f.o.b., Glasgow; ell, 7s. to 7s. 3d.; and splint, 7s. 3d. to 7s. 6d. The shipments for the week amounted to 133,597 tons—an increase of 2125 tons upon the preceding week, and of 13,473 tons upon the same week of last year. For the year to date, the shipments have been 1,277,761 tons—an increase upon the corresponding period of last year of 30,174 tons.

Wrotham Water Supply.—Colonel Yorke recently held a Local Government Board inquiry at Wrotham with reference to the provision of a water scheme for the district. Mr. Wedderburn appeared for Mr. C. G. Hale, who has generously offered to provide the District Council with water from springs on his land; but the offer was refused by the Council. His proposal was briefly to utilize a very powerfuls pring which rose at Street Hill, establish near it a pumping-station, and pump the water into a reservoir 540 feet above. With regard to the volume of water required to supply 4000 inhabitants, he could distribute 60,000 gallons a day. The proposed reservoir would be high enough to serve the whole district by gravitation. It would hold 140,000 gallons.

The Coventry Corporation and the North Warwickshire Water Bill.—It seemed probable a short time ago that the above-named Bill, the object of which is the incorporation of a Company to supply Foleshill and other places with water, would encounter considerable opposition from the Coventry Corporation, whose area was deemed to be affected by the measure. Arrangements have, however, been come to which will probably render this unnecessary, and enable the Bill to go forward unopposed. The promoters have undertaken to modify it in three particulars. In the first place, they exclude the parishes of St. Michael's Without and Holy Trinity Without from their proposed area of supply; secondly, they are to be empowered to sink wells at Corley and Keresley, and also to purchase 20 acres of land in the district. The Coventry Corporation feared that the latter power might be used to the detriment of their own water supply in the Upper Sherborne Valley; and the promoters have consented to insert a clause forbidding them to use the land in question for the purpose of boring for water. A third objection of the Corporation had relation to Foleshill and Stoke—two populous parishes adjoining the city, the annexation of which had been contemplated. The Bill will now provide that, in the event of either or both of these places being taken into Coventry within seven years, the price to be paid the Company hereafter formed shall be settled by arbitration under the Lands Clauses Act. The area which the promoters will have is a wide one, running from Corley on the west to Binley on the east, and from Exhall on the north to Foleshill on the south.

The Welsh Water Scheme of the Birmingham Corporation.—At the Royal Institution on Friday, Mr. J. Mansergh, M.Inst.C.E., delivered a lecture on the above subject before a large audience. Sir F. J. Bramwell, Bart., F.R.S., occupied the chair. The lecturer said the area of the city of Birmingham was about 12,000 acres, and the limits of the supply covered more than 83,000 acres, or 10 per cent. in excess of that of the County of London. The district varied very considerably in elevation; being 270 feet above sea-level in one place, and 800 feet above it in another. The population was about 700,000. In 1890 he was consulted by the Corporation; and it was on his advice that they promoted the Bill of 1892 for the utilization of the waters of the Rivers Elan and Claerwen, tributaries of the Wye. In order to secure that the water should be unpolluted, they asked Parliament to give them control over the whole drainage area. This led to very great opposition from landowners, commoners, authorities on the line of route, and even from the London County Council, who said that they might themselves want the source of supply. In addition to this, there was a great fight regarding the amount of compensation water to be allowed for the right to divert the water sought. Eventually, as a compromise, this was fixed at 27 million gallons a day. At the point where this bulk of water had to be discharged into the river, experience now showed that in very dry weather the flow fell to 4½ million gallons; so that the quantity passing down, as soon as any water was taken to Birmingham, would be increased sixfold. The capability to do this was, of course, due to the storing of flood waters. The collecting area was 45,562 acres; and by means of a model and pictures thrown on a screen, Mr. Mansergh indicated with considerable clearness its wild nature. In determining the rainfall, they were much aided by the fact that the Lord of the Manor—Mr. Robert Lewis Lloyd—had kept at the family mansion of Nant Gwillt a rain-gauge since 1871. With the aid of this and other gauges fixed by Mr. Symons, it was decided that the mean annual fall of a long series of years upon the water tide could be taken at 68 inches, and the average of three consecutive dry years at 55 inches; the latter being the figure adopted in all the calculations. The greatest rainfall—viz., 93·86 inches—was in 1872; and the least, 43·41 inches, in 1892. It was usual to allow 14 inches for evaporation; but, to be on the safe side, 19 inches were taken from the 55—leaving 36. Taking the mean of three dry years, the rainfall in one year would leave available 165 million tons of water. He was satisfied they could obtain 75 million gallons daily for their supply. The length of drought guaranteed against was 180 days, which necessitated a storage of 18,000 million gallons. A unique feature in the scheme was the provision of a submerged dam, to be built across the Cabanloch reservoir, 1½ miles above the main dam, the chief object of which was to hold the water up behind if high enough to charge the aqueduct conveying it to Birmingham. The scheme was such that it could be carried out in instalments; reservoirs being made as required. There were very few stone dams of any size in England; but the Elan and Claerwen Valleys were peculiarly adaptable for such structures, and stone would therefore be largely used for the purpose. When the Caban dam was finished, the total pressure against its exposed face would be 60,000 tons.

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Large Order for Welded Steel Pipes.—Probably the most important order that has ever been placed for welded steel pipes of large diameter has been secured by Messrs. T. Piggott and Co., Limited, of Birmingham. It consists of about 7000 tons of 42-inch pipes, which are to be used in the new water scheme of the Birmingham Corporation. The work will be carried out to designs prepared by the Engineer, Mr. J. Mansergh, Vice-President of the Institution of Civil Engineers, who last Friday, at the Royal Institution, gave an exceedingly interesting account of the scheme, illustrated by lantern views.

Sales of Shares.—At a sale of miscellaneous shares last Tuesday at Sheffield, £120 of "C" stock in the Sheffield Gaslight Company was sold at the rate of £254 10s. per cent. On the following day, Mr. Alfred Richards sold at the Mart, Tokenhouse Yard, E.C., by order of the Directors, 650 £10 shares in the Lea Bridge District Gas Company, ranking for a standard dividend of 7 per cent. per annum, subject to the sliding-scale; the last dividend on similar shares having been at the rate of 8 per cent. The shares were bought at prices ranging from £19 15s. to £20 5s. each; the average price being £20 1s. 5d., yielding £3 19s. 8d. per cent. on the investment. The total realized was £13,045.

Messrs. Graham, Morton, and Co., Limited, is a new private Company formed for the purpose of carrying on a specialty business as engineers and contractors for the construction of inclined retorts, charging apparatus, and conveying and elevating machinery to deal with coal, coke, or any class of material. The active part of the business will be undertaken by Mr. Maurice Graham, as Managing-Director, who has been intimately connected with the gas profession for the past sixteen years in the construction and erection of all classes of gas plant. His colleague, whose name is included, is Mr. Joseph Morton, of Halifax, who is also well known, and who is a Director of the Leeds Fire-Clay Company, Limited. The head office of the Company is at Amberley House, Norfolk Street, Strand, W.C.

The Consumption of Gas in Manchester.—A slight decrease is reported in the consumption of gas in the area supplied by the Manchester Corporation during the past year, as compared with the preceding one. During the first six months of the departmental year—from April 1 to Sept. 30—there was an increase in the consumption equal to 5·65 per cent. over the quantity consumed in the corresponding period of 1896. From Oct. 1 to Feb. 12, there was a decrease of 6·02 per cent. compared with the same period a year ago; but from Feb. 18 to the 13th inst., there was an increase over last year's figures of precisely the same extent —6·02 per cent. The foggy days during the last-mentioned period fully account for the increase, just as the exceedingly open and mild winter explains the decrease which took place between October and February. Taking the period between April 1 last and the 13th inst., there is a decrease in the consumption to the extent of 1·13 per cent. as compared with the figures for the corresponding period of 1896-7. As accounting for this decrease, it is pointed out that the average mean temperature for the quarter ending Dec. 31 was only 3½° lower than that for the June quarter of last year; while the temperature during January was only 2° lower than that for May.

Allendale (Northumberland) Water Supply.—The new water supply for the town of Allendale has lately been publicly opened. The water is brought a distance of about a mile and a half, from a spring on the Park Gates Farm, in a 3-inch main. A storage reservoir, to hold 30,000 gallons, forms part of the scheme, but remains to be completed. The work has been carried out according to plans prepared by Mr. M. Waugh, Surveyor to the Rural District Council.

Reductions in Price.—On the recommendation of the Gas Committee, the St. Mary Church District Council have decided to reduce the price of gas from 4s. 6d. per 1000 cubic feet for public and 3s. 9d. for private lighting, to 3s. 6d. for all purposes. The Carrick-on-Suir Gas Company have given notice that the price to be charged for gas used during the summer months of each year—*i.e.*, from April 1 to Oct. 1—in excess of the tabulated consumption with which the consumers have been familiar, will be reduced from 5s. to 3s. 4d. per 1000 cubic feet. This concession will take effect as from the 1st prox.

Long Eaton Gas Company, Limited.—At the annual general meeting of this Company last Thursday, the Directors reported a continued increase in the business. They were encouraging as much as possible the use of gas for cooking, heating, engines, &c.; and the result had been eminently satisfactory. The revenue was £9060 (£7284 being for gas); the expenditure, £5051—leaving a balance of £4009. The amount available for distribution was £3926; and the Directors recommended dividends of 6s. each on the "A" shares; and 4s. each on the "B" shares—making with the interim dividends 10s. and 7s. per share respectively, free of income-tax. They also recommended writing off £1250 for depreciation, and reducing the price of gas to 2s. 9d. per 1000 cubic feet. The report and recommendations were agreed to.

St. Albans Gas Company.—The annual meeting of this Company was held last Tuesday—Mr. T. Kent presiding. It was stated in the report that during the past year a new trunk main had been laid through the city, which would be equivalent to an increased output of gas to the extent of 50 per cent. In spite of the mild winter, the sale of gas showed an increase of 3½ million cubic feet, and there had been 102 new consumers. There were 148 houses fitted with prepayment meters. The residuals had, however, sold badly; sulphate of ammonia being particularly depressed. To provide capital for further extensions, 300 fresh shares of £10 each would be issued, and £2000 would be raised on debentures. The report was adopted and a dividend of 7½ per cent. was declared. The Directors and the Engineer (Mr. A. F. Phillips, M.Inst.C.E.) having been thanked for their services, the latter, in reply, said a great many shareholders had spoken to him about the electric light, with which they were threatened. He was a friend of the light; and if he had had his way it would have been in St. Albans before this. The Gas Company approached the Corporation, suggesting co-operation; but the Corporation preferred to carry out their Order by themselves. He believed the Company had a staff and plant which would enable them to supply electric light on better terms than anyone else, and with a profit, which he did not anticipate would be the result with the undertaking in the hands of the Corporation.

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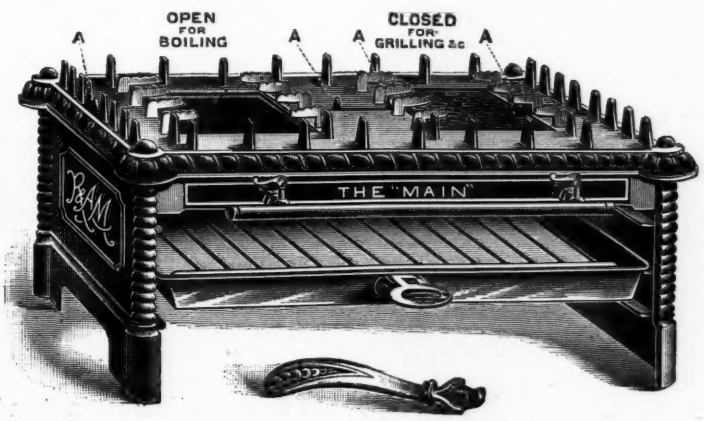

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New Joint-Stock Companies.—The New Cottenham Gas and Water Company, Limited, has been registered with a capital of £5000, in shares of £2 10s. each, for the purpose of supplying Cottenham, in Cambridgeshire, with gas and water. The firm of Best and Lloyd has, for personal and private reasons, been registered as a limited liability Company, with a capital of £50,000, in £10 shares, to take over as from the 31st inst., the business now carried on at Cambray Works, Handsworth, Birmingham. The Northern Acetylene Gas and Carbide Company, Limited, with a capital of £5000, in £1 shares, will take up the business of manufacturing acetylene-gas generators. The Acme Unbreakable Chimney Company, Limited, with a capital of £10,000, in £1 shares (3000 being 6 per cent. cumulative preference), is to acquire the business of a mica lamp-chimney manufacturer, carried on by Mr. T. Redman at Bradford, and deal with two patents.

Richmond (Surrey) Water Supply.—At a recent meeting of the Richmond Town Council, an important report upon the water-works was presented by the Chairman of the Water Committee (Mr. T. H. Watney). In the course of his remarks thereon, he said with regard to the £5000 granted for the Terrace Gardens well works for additional driving, some £2473 had been spent in lengthening the adits by 2373 feet, at a cost of £1 0s. 11d. per foot, as against the estimate of £1 3s. 10d. per foot; and whereas the yield from the well and the Thanet sand water for the month ending Dec. 9, 1896, was 229,765 gallons per day, it was now 262,557 gallons per day; showing an increase of 32,792 gallons a day. The expenditure under the head of mains had exceeded the loan sanctioned (£3500) by £813. It was decided to apply to the Local Government Board for power to borrow £1857, to pay off this £813, and meet the expenditure of £690 and £354 for further extensions of mains throughout the district.

The Cray Water-Works of the Swansea Corporation.—The minutes presented by the Water Committee at the meeting of the Swansea County Council last Wednesday contained a recommendation that the tender of Messrs. John Paterson and Co., Limited, of Gasgow, be accepted for the construction of the Cray water-works, at the sum of £255,747. The adoption of the minutes was moved by Mr. Freeman, who remarked that the expenditure would be extended over a long period; and all the Committee now asked was that the Council should consent to the contract being entered into. The motion having been seconded, Mr. Rocke said they had already spent about £100,000 on the scheme; and he desired to know how much more was likely to be required before the completion of the work. The Chairman, in reply to this and other questions, said their borrowing powers amounted to £270,000, and they had already spent £90,000; so that they were short by about £76,000. He believed this would cover everything. The minutes were adopted.

Waterborne Typhoid.—At the Sanitary Institute recently, a paper was read by Dr. Childs, of University College, on the above subject. After reviewing the various causes of typhoid fever, he pointed out that the protection of water supplies was the one measure calling for immediate action. The present law was quite inadequate. The first requirement was the thorough and systematic inspection of the water supplies from source to distribution; but the duty of taking action was thrown on the sanitary authorities who had only enabling, not compulsory, powers, and were themselves often the greatest polluters. The chief obstacle to reform was the ignorance and indifference of the public. He concluded by recommending: (1) That sanitary authorities should have free access to water supplies and should provide for their inspection and analysis; (2) that water companies should publish full information as to their water; (3) that they should be required to make regular inspections and analyses, and publish the reports; (4) that they should be made responsible for the consequences of pollution; (5) that wilful pollution of water should be a penal offence; and (6) that public authorities should be appointed for the care and protection of watersheds. A discussion followed. Dr. Sims Woodhead drew attention to the vitality of the typhoid bacillus in soil, and the consequent need of preventing soil pollution. He suggested that sanitary authorities should have rights of supervision over water companies, and that the responsibility for pronouncing on the sufficiency of the water should fall upon them. The whole question should be placed under the control of a Central Board. Major Lamorock Flower, the Engineer to the Lea Conservancy Board, advocated individual action in getting rid of river pollution. Dr. Parkes thought the protection of watersheds might very well be entrusted to County Councils.

The Water Supply of Cardiff.—An interesting lecture on the water supply of Cardiff has been delivered by Mr. Allen, who is one of the members of the Town Council. He said that up to 1878, the inhabitants were supplied from Ely and Lisvane. In that year the Water Company applied for powers to extend their works; and the same year the Corporation bought up the concern for £300,000. The Taff Fawr scheme was adopted in May, 1883. When it first came before the Council it met with much opposition; but he did not suppose that to-day there were a dozen persons in Cardiff who would deny that in taking up the scheme the Corporation did the right thing. The water was brought down from Taff Fawr in an iron conduit 24 to 30 inches in diameter and 32 miles in length; and it was capable of conveying 12 million gallons of water per day. The reservoir was opened in 1897. On the completion of No. 2 reservoir, Cardiff was supplied with 4½ million gallons per day; and the Beacons reservoir gave an additional 3 million gallons—making a total of 7½ million gallons per day. This was sufficient for a population of 300,000, which the Engineer (Mr. Williams) believed Cardiff would reach in 1909. Looking at the scheme from a financial point of view, the lecturer said the present revenue was £50,000 a year. The additional 3 million gallons per day from the Beacons reservoir would earn a further revenue of £30,000 when fully utilized; and then it was estimated that the surplus net profit would be £10,000 per annum, which could be applied to the reduction of local rates. When No. 3 reservoir was completed, the town would have another 3 million gallons, making a total of 10½ millions, and capable of earning a further £30,000. This would bring the revenue to £110,000 per annum, leaving a net revenue of £88,000. After deducting all charges for interest and sinking fund on a capital expenditure of £1,500,000, it was estimated there would be a surplus profit of £30,000 per annum.

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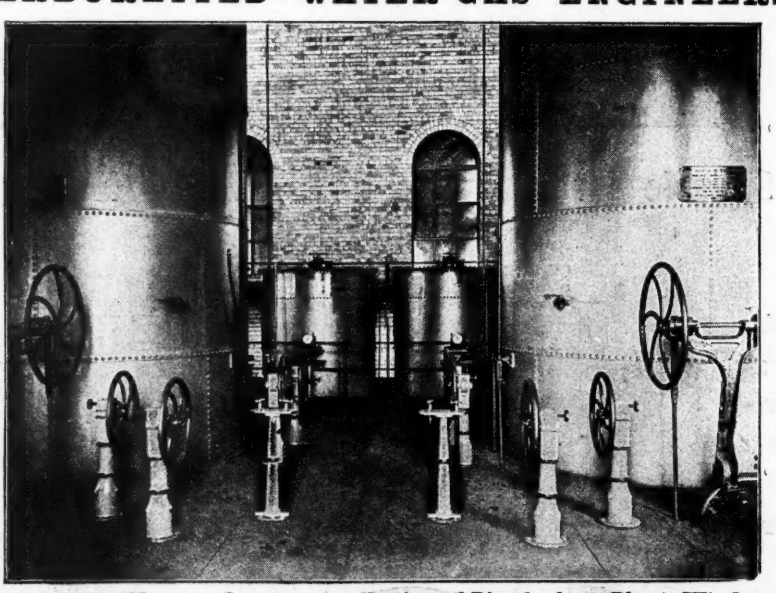

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Belfast City and District Water Supply.—The newly-elected Chairman of the Belfast City and District Water Commissioners (Mr. E. W. Pim), in the course of an address to his fellow-members last Tuesday, gave many interesting particulars as to the past and present position of the undertaking which they control. Among other points, he mentioned that since the present Board were established they had spent £1,143,253. They had borrowed about £1,300,000; had paid back about £100,000; and were accumulating a sinking fund now at a rate of £8000 a year. The income last year was more than £60,000. The quantity of water sold was 815 million gallons; and besides that charged as "small specials" and to the Council for public purposes, over £30,000 was received as rates. The expenditure was almost as great as the receipts; £45,000 alone being required for interest and sinking fund. With all this their rates were low. An occupier of a house valued at £6 had a full supply of water for about 1d. a week; while a ratepayer living in a £30 house paid but 1d. a day for this valuable commodity

The Proposed Transfer of the Heywood Water-Works to a Joint Board.—At the last monthly meeting of the Heywood Town Council, the terms of the arrangement with the Middleton Corporation for the transfer of the Heywood Water-Works to a Joint Board were submitted. They are as follows: (1) "That the management and control of the water undertaking of the Heywood Corporation shall be transferred to a Joint Board; (2) that the said Joint Board shall consist of twelve members, six of whom shall be appointed by the Heywood Town Council, and the remaining six by the Middleton Town Council; (3) that the Corporations of Heywood and Middleton shall become joint owners of the water undertaking, and shall be equally entitled to the assets and income thereof, and equally responsible in respect of the liabilities thereof, including all securities now charged upon the same, or upon the district fund or rate of the borough of Heywood, and all contributions to the sinking fund; and (4) that the current rates charged for water, including the proportionate share of the water revenue payable by the Heywood Corporation under section 18 of the Heywood Corporation Act, 1883, shall be continued until the Heywood Corporation shall have received from the surplus revenues of the water undertaking the sum of £25,000 towards the deficiences made good by that Corporation since the purchase of the undertaking in 1877." Alderman Lawton, the Chairman of the Finance and General Purposes Committee, stated that the previous evening the terms were exhaustively discussed, and, with one or two slight modifications, were unanimously approved. They thereupon received the sanction of the Council.

Maldon Water Supply.—A special meeting of the Maldon Town Council was held on the 11th inst.—The Mayor (Alderman E. A. Fitch) presiding—when the principal matter under consideration was the proposed acquisition of the undertaking of the Maldon Water Company by the Corporation. The Mayor and the Town Clerk (Mr. J. C. Freeman) had met the Chairman (Mr. T. E. Bland) and the Secretary (Mr. J. Rogers) of the Company and discussed the question; and the Mayor submitted a report setting forth the result. It had been arranged that the clause in the agreement for the extra price to be paid for compulsory purchase should not be calculated on the amount of debentures, mortgages, encumbrances, debts, and liabilities of the Company; also that the clause which stated that the Corporation should purchase the undertaking as if the Company had obtained parliamentary powers should be struck out. A further claim was made by the Company—viz., that the Secretary and Manager, who, being a member of the Council, would have to give up his appointment, should be compensated. The claim for the compensation of the Directors had been waived. It was suggested that the Corporation should adopt the Water Bill, and by a clause to be inserted therein get power to borrow the purchase-money, to be repaid in fifty years. The Mayor proposed that the Town Clerk take the necessary steps to carry the agreement into effect, and to amend the Bill accordingly. Mr. Bentall seconded the motion. The question of the amount of the compensation to be paid to the Secretary and Manager under this agreement was then raised; and ultimately it was decided that five years' salary, as had been arranged by the Parliamentary Agents on both sides, should be agreed to. The Mayor's motion was then carried. The Mayor further moved that the Town Clerk should take such steps as might be necessary to obtain the sanction of the Local Government Board to the promotion of the Bill by the Corporation; and this was carried.

Messrs. Falk, Stadelmann, and Co., Limited, have just supplied 60 of their "Veritas" arc lanterns to the Corporation of Liverpool, for incandescent street lighting.

At the annual meeting of Crossley Brothers, Limited, last Wednesday, the Directors reported profits amounting to £93,000. The amount at the disposal of the Directors was £72,845, out of which an interim dividend had been paid on the preference shares at the rate of 5 per cent. per annum, and on the ordinary shares at the rate of 7½ per cent. per annum, to June, 1897, amounting to £14,000; leaving £58,000 for disposal. Out of this the Directors proposed to pay a further dividend for the second half of the year at the rate of 5 per cent. per annum on the preference shares, and 8 per cent. per annum on the ordinary shares, amounting to £33,000; leaving a balance of £25,000. Of this it was proposed to put £24,000 to the reserve fund; leaving £1000 to be carried forward. The Chairman (Mr. W. J. Crossley) said the balance-sheet was the best they had had since the expiration of their patents in 1890. This year a good start had been made; and in February they sold no fewer than 296 engines. The report was adopted.

In the week ending the 12th inst., a gas exhibition was held in the Public Hall, Marsden, under the auspices of the District Council. Messrs. C. Wilson and Sons, of Leeds, had a large selection of cooking and heating stoves, &c.; and Messrs. Sawer and Purves, Messrs. Orme and Co., and Messrs. J. & J. Braddock lent a number of wet and dry meters in glass cases, so that the working parts could be seen. The arrangements were carried out by Mr. F. Lee, the Gas Manager to the District Council; and they included a good show of Welsbach incandescent lamps. Cookery lectures were delivered by Madame Alting-Mees. Messrs. Fletcher, Russell, and Co., are holding an exhibition of their gas appliances in the Church Institute, Leeds, with lectures by Mrs. H. Young. The same firm and Messrs. John Wright and Co. were last week showing examples of their manufactures at an exhibition promoted by the Newmarket Gas Company, at which the cookery lectures were delivered by Mrs. Collins. Messrs. W. Parkinson and Co. held a successful gas exhibition, under the patronage of the Manchester Corporation Gas Department, in the Liberal Club, Moss Side, Manchester, from Monday to Friday last week; practical lessons on cookery being given twice daily by Miss Edith Sanderson. Messrs. C. Wilson and Sons, of Leeds, were exhibiting at Driffield last week; and a series of lectures was delivered by Mrs. C. F. Pitcher. The Planet Foundry Company, of Ashton, held an exhibition of gas-stoves in the town during the week; and the excellence of their manufactures was amply demonstrated by Miss Baines.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

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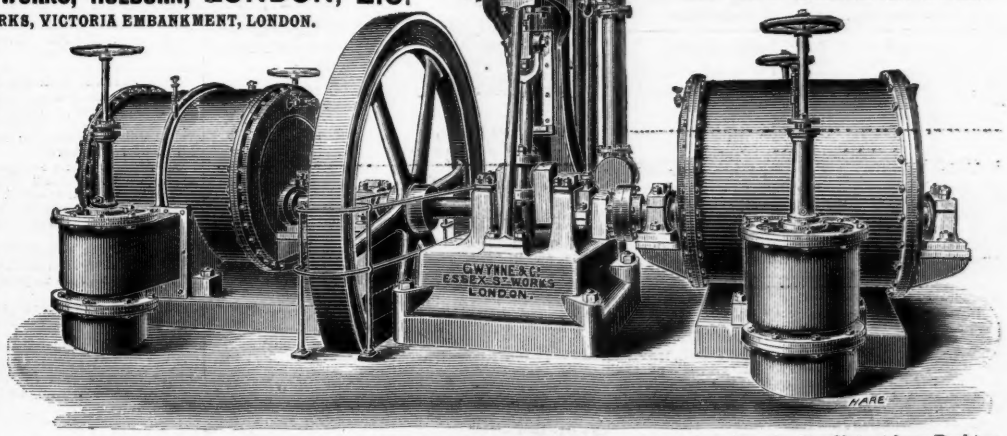

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[For Illustrated Advertisement, see March 1, p. 506.]

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Apply, by letter, to No. 3019, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

SULPHURIC ACID for Sale.

BROTHERTON AND Co., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

FOR SALE—12-inch Governor by Peebles. 42 4-inch White's ANTI-DIP VALVES. No reasonable offer refused.
Apply to the MANAGER, Gas-Works, ILKESTON.

GAS-PUMP for Sale, horizontal, one Steam Cylinder, 18-inch bore, and two Gas Cylinders, 17½-inch bore, all 24-inch Stroke, on massive Bed-Plate, with heavy Fly-Wheels. Very strong. First-Class Make. Not much used.
Apply, by letter, to No. 2878, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE, as a Going Concern—A small GAS-WORKS (Freehold Property) near the Eastern Coast.
The Works are in full working order; and there is a good Coal Business attached.
Apply, in first instance, to Mr. W. H MORGAN, Consulting Gas and Chemical Engineer, RHAYADER.

FOR SALE—A Modern Sulphate of AMMONIA STILL, built by Messrs. R. & J. Dempster, Manchester, 1893, with separate Liming Compartment. Capacity, with ordinary Liquor, 5000 to 6000 lbs. of Sulphate per day.
For further Particulars, apply to the BRYMBO STEEL COMPANY, LIMITED, near WREXHAM.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. **Compare Prices and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

FOR SALE, Cheap—The undermentioned GAS PLANT:—

	Square. Ft. in.	Deep. Ft. in.	
2 PURIFIERS,	8 0	4 6	6-in. Valves & Connections.
1 ,,	7 6	4 6	6 ,, ,, ,,
2 ,,	5 0	4 0	4 ,, ,, ,,
1 ,,	5 0	2 9	4 ,, ,, ,,

C.-I. SCRUBBER, 38ft. 6in. high, 6ft. dia., 14-in. ,,
CONDENSER, 4 inches diameter, Vertical Pipes.
EXHAUSTER (Gwynne's) 20,000 c.f. per hour 8-in. Valves
Apply to SAML. WHILE AND SONS, 60, QUEEN VICTORIA STREET, E.C.

CORPORATION OF LONGTON, STAFFS.

TENDERS FOR MAIN PIPES.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply and delivery of 1200 yards or thereabouts of 8-inch MAIN PIPES, 700 yards or thereabouts of 6-inch MAIN PIPES, together with any SPECIAL CASTINGS that may be required.
Specification can be obtained from the Engineer.
Tenders, addressed to John L. Johnson, Chairman Gas Committee, and endorsed "Tenders for Main Pipes," to be delivered at these Offices not later than Tuesday, the 29th day of March next.
The Committee do not bind themselves to accept the lowest or any Tender.
WILLIAM S. MCGREGOR,
Engineer.
Offices: Heathcote Road, Longton.

BOROUGH OF RICHMOND (SURREY) WATER-WORKS.

WATER-MAINS.

TENDERS are invited for providing for the Borough of Richmond (Surrey) Water-Works as follows: WATER-MAINS, of best grey Metal, 90 tons (more or less), sizes 4 inches and 6 inches, coated with Dr. Angus Smith's Solution.
Specifications, with Form of Tender (for which a charge of One Guinea will be made, which will be returned on receipt of a *bonâ-fide* Tender) and further Information may be obtained on application to Mr. W. G. Peirce, Borough Water-Works Engineer, Riverside, Richmond, Surrey.
No Tender will be recognized unless properly filled up on prescribed Form attached to Specification, nor unless the same is received at the Town Clerk's Office, within the time limited; and no expenses or claim will be allowed or paid to any person whether tendering or not.
The Contractor will be required to enter into a contract and bond as security for the due performance of his Contract as stipulated by the Public Health Act, 1875.
The Form of Contract and Bond will be prepared by the Town Clerk, at whose Office particulars thereof may be obtained.
Sealed Tenders, endorsed "Tender for Water-Mains," and addressed to the Chairman of the Water Committee, must be delivered at the Town Hall, Richmond, by Four o'clock p.m., on Tuesday, the 29th day of March, 1898.
FREDK. B. SENIOR,
Town Clerk.
Town Hall, Richmond,
Surrey, March 10, 1898.

BALLYMENA AND HARRYVILLE GASLIGHT COMPANY, LIMITED.

THE Ballymena and Harryville Gaslight Company, Limited, invite TENDERS for 1700 Tons of best screened GAS COAL, free on Waggons at Larne Harbour, to be delivered before the 1st of November next.

Payment to be made on the first Thursday in March, 1899.

Tenders to be lodged with me on or before the 24th of March, 1898.

THOMAS C. C. HOOD,
Secretary.

Ballymena, March 12, 1898.

COUNTY BOROUGH OF ST. HELENS.

THE Gas Committee are prepared to receive TENDERS for the supply of a 20-TON STILL, for their Sulphate of Ammonia Works.

Full Particulars may be obtained upon application to the undersigned.

Tenders, endorsed "Sulphate Still," to be addressed to the Chairman of the Gas Committee, and delivered at these Works not later than Tuesday, the 12th of April next.

The Committee reserve to themselves the right to decline the lowest or any Tender.

SAMUEL GLOVER,
Engineer and Manager.

Gas-Works, Warrington Old Road,
St. Helens.

TUNBRIDGE WELLS GAS COMPANY.

TO COAL FACTORS AND OTHERS.

THE Directors of the Tunbridge Wells Gas Company will be prepared on Tuesday, the 12th day of April next, to receive TENDERS for the supply of 20,000 Tons of good, clean, unscreened GAS COALS, to be delivered free into the Gas Company's Siding on the South-Eastern Railway, at Tunbridge Wells, in accordance with the Terms and Conditions which may be obtained on application.

The Tenders to be sent to me by not later than Six o'clock p.m., on Tuesday, the 12th day of April, marked "Tender for Coals."

The lowest or any Tender will not necessarily be accepted.

By order,
JOHN READ,
Secretary and General Manager.

Gas Company's Office: 44, High Street,
Tunbridge Wells, March 17, 1898.

COUNTY BOROUGH OF BURNLEY.

GAS AND OTHER COALS.

THE Corporation of Burnley are pre- pared to receive TENDERS for the supply for One, Two, or Three Years of 4000 Tons of CANNEL per annum, and of such quantity of GAS COAL as may be required (approximately estimated at 48,000 Tons per annum), to be delivered in such quantities and at such times as the Gas Engineer of the Corporation may from time to time require.

TENDERS are also invited for the supply of HOUSE and STEAM COAL to the various Departments of the Corporation.

Printed Forms of Tender and Conditions of Contract may be obtained on application to Mr. J. P. Leather, Gas Engineer, Gas-Works, Burnley.

Tenders, which must be on the printed form, and addressed to the Chairman of the Gas Committee, Town Clerk's Office, Burnley, marked "Tender for Gas Coal," or "Tender for House and Steam Coal," as the case may be, must be delivered not later than Wednesday, the 30th inst.

By order,
WM. T. FULLALOVE,
Town Clerk.

Town Hall, Burnley,
March 8, 1898.

COUNTY BOROUGH OF BURNLEY.

TO TAR DISTILLERS.

THE Gas Committee of the Corporation of Burnley are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Gas-Works during the period of Twelve Months ending March 31, 1899.

The Tar will be delivered by the Corporation into Boats provided by the purchaser at the Gas-Works Wharf on the Leeds and Liverpool Canal.

Tenders, under seal, endorsed "Tender for Tar," and addressed to the Chairman of the Gas Committee, Town Clerk's Office, Town Hall, Burnley, to be delivered not later than Wednesday, the 30th of March, 1898.

JNO. P. LEATHER.

Gas-Works, Burnley,
March 10, 1898.

FARNHAM GAS COMPANY LIMITED.

TENDERS FOR COAL.

THE Directors of the Farnham Gas Company, Limited, are prepared to receive TENDERS from Persons willing to supply and deliver, free of all dues and charges, at the Farnham Station, London and South-Western Railway, 2200 Tons of the following descriptions of Gas Coal, viz., NEW PELTON, PELAW MAIN, ALDWARKE MAIN, or STRAFFORD SILKSTONE, to be delivered in quantities of 50 Tons (at intervals) before the 31st of March, 1899. The Coals to be consigned to the order of the Farnham Gas Company, Limited, at the Farnham Railway Station.

In the case of Seaborne Coal, the Meter's Certificate of each quantity to be duly sent with Invoice of same.

Payment Monthly.

Sealed Tenders, marked "Tender for Coal," to be delivered to the Secretary, Mr. W. Wells, 112, West Street, Farnham, Surrey, not later than Eleven o'clock a.m., on Saturday, the 2nd of April, 1898, of whom Forms of Tender may be obtained.

The Directors reserve the right to reject the lowest or any Tender.

March 15, 1898.

STATION METER.

THE Directors of the Tynemouth Gas Company are prepared to receive TENDERS for the supply and erection of a STATION METER, to pass 70,000 cubic feet of Gas per hour, at their Works, North Shields.

Sealed Tenders to the undersigned on or before Tuesday, April 5.

WM. HARDIE, jun.,
Engineer.

Gas-Works, North Shields,
March 18, 1898.

WINDSOR ROYAL GASLIGHT COMPANY.

THE Directors invite Tenders for the supply and erection of a GAS PURIFIER 20 feet by 14 feet by 4 ft. 9 in. deep, with Foundations, Brickwork, Woodwork, &c.

Drawings and Specification may be seen and copied, between the hours of Nine a.m. and Five p.m. at the Offices of the Company, 15, Victoria Street, Windsor.

Tenders, endorsed "Tender for Purifier," &c., and addressed to the Secretary, on or before Monday, April 4, 1898.

The Directors do not bind themselves to accept the lowest or any Tender.

March 14, 1898.

TENDERS FOR GAS COAL.

THE Corporation Gas Committee of Stoke-upon-Trent invite TENDERS for the supply of GAS COAL.

Specification and Form of Tender may be obtained on application to the undersigned, or at the Gas Offices.

Tenders to be sent in not later than Twelve o'clock noon, the 24th of March, 1898, addressed to the Mayor (F. Geen, Esq., J.P.), Stoke-upon-Trent, and endorsed "Tender for Gas Coal."

WM. PRINCE,
Engineer and Manager.

Gas-Works, Stoke-upon-Trent.

SKIPTON GAS COMPANY.

THE Directors of this Company are pre- pared to receive TENDERS for the supply of 7000 Tons of best screened GAS COAL, to be delivered in such quantities, and at such times as may be required during Twelve Months ending June 30, 1899.

Quotations to specify price per ton free on rails at Skipton, or delivered into the Company's Coal-Sheds alongside the Canal. Endorsed Tenders to be sent to me not later than April 11 next.

The Directors will not be bound to accept the lowest or any Tender.

J. HAIGH,
Secretary.

March 14, 1898.

COUNTY BOROUGH OF HALIFAX.

TO ENGINEERING CONTRACTORS.

THE Corporation of Halifax are prepared to receive TENDERS for the supply and erection of Four PURIFIERS, with Centre-Valves, Connecting-Pipes, &c.

Form of Tender, Specification, and Print may be obtained on application to Mr. Thomas Holgate, Gas Engineer, Gas-Works, Halifax.

Sealed Tenders, endorsed "Purifiers," must be sent to the undersigned before Ten a.m. on Thursday, the 31st of March, 1898.

The person whose Tender is accepted will be required to observe the fair contracts clauses adopted by the Corporation.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
KEIGHLEY WALTON,
Town Clerk.

LURGAN GAS, LIGHT, AND CHEMICAL COMPANY, LIMITED.

COAL WANTED.

THE Directors invite Tenders for the supply of 3000 Tons best quality screened GAS COAL delivered into Lighters, or placed on Rail, at Belfast.

One-third of the required quantity should be Scotch Coal, suitable for use in Hislop's Patent Regenerative Furnaces.

Delivery of 2500 Tons can be taken before the 1st of November; the remainder to be delivered at such times and in such quantities as may be required. Each cargo must be accompanied by a certificate as to place of origin.

Tenders (in sealed envelope), accompanied by reference to Gas-Works using the Coal offered, should reach me not later than Eleven o'clock in the forenoon of Saturday, April 2, 1898.

The Directors do not bind themselves to accept the lowest or any Tender.

FRED. W. MAGAHAN,
Secretary.

Gas-Works, Lurgan,
March 14, 1898.

COMMERCIAL GAS COMPANY.

NOTICE is Hereby Given, that an ORDINARY MEETING of the Commercial Gas Company will be holden at the Cannon Street Hotel, in the City of London, on Thursday, the 7th of April, 1898, at Twelve o'clock at noon,

To receive the Directors' Report and the Accounts of the Company for the Half Year ended the 31st of December, 1897;

To declare a Dividend;

And to elect Directors and an Auditor in the place of those retiring.

The STOCK TRANSFER BOOKS WILL BE CLOSED from the 25th of March inst. to the 7th of April next, both days inclusive.

By order of the Board,
H. D. ELLIS,
Secretary.

Offices, Stepney,
March 17, 1898.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held MONTHLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by Auction of Gas and Water Stocks and Shares under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards's Offices, 18, FINSBURY CIRCUS, E.C.

By order of the Directors.

2500 SHARES IN THE

WEST HAM GAS COMPANY.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Tuesday, March 29, at Two o'clock, in Lots, 2500 £10 (fully-paid) SHARES in the above Undertaking, to be issued under the Provisions of the West Ham Gas Act, 1889; the Dividends on these Shares rising or falling according to the Price charged for Gas. The last Dividend on the Company's £10 Shares was at the rate of 7 per cent. per annum.

Particulars of the SECRETARY of the Company, at the Offices, STRATFORD; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the Hornsey Gas Company, the Directors of the Maidstone Gas Company, and other Owners.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Monday, April 4, at Two o'clock, in Lots:

HORNSEY GAS COMPANY—£5000 FIVE PER CENT. PREFERENCE STOCK.

MAIDSTONE GAS COMPANY—£6000 THREE PER CENT. PERPETUAL DEBENTURE STOCK;

Also Shares in the

BOURNEMOUTH GAS AND WATER COMPANY, ASCOT DISTRICT GAS COMPANY, and WALTON-ON-THAMES GAS COMPANY.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

SALE OF NEWPORT (MON.) GAS SHARES.

(UNDER THE PROVISIONS OF THE COMPANY'S ACT, 1886.)

MR. THOMAS PARRY has received Instructions from the Directors to SELL BY PUBLIC AUCTION, at the

KING'S HEAD HOTEL, NEWPORT, MON.,

on

WEDNESDAY, THE 30th DAY OF MARCH, 1898,

At Three o'clock in the Afternoon,

SIXTY CLASS "C" SHARES OF £100,

IN LOTS OF ONE SHARE EACH.

THE STATUTORY DIVIDEND IS 7 PER CENT. PER ANNUM.

Particulars and Conditions may be had on application to the AUCTIONEER, Albany Chambers, NEWPORT, or to

MR. EDWARD F. MARFLEET,
Secretary,

at the Offices of the Company, NEWPORT, MON.

Dated 25th February, 1898.

Ready this Day—450 *Pages, Crown* 8*vo., with numerous Illustrations,* 10*s.* 6*d. Leather.*

THE

GAS ENGINEER'S POCKET BOOK,

Comprising Tables, Notes, and Memoranda relating to the Manufacture, Distribution, and Use of Coal Gas, and the Construction of Gas-Works.

By HENRY O'CONNOR, Assoc.M.Inst.C.E.

London: CROSBY LOCKWOOD & SON, 7, STATIONERS' HALL COURT, E.C.

COKE-BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT)

With Elevators and Conveyors worked by Steam or Gas Engine.

GEORGE WALLER & CO.,
165, QUEEN VICTORIA STREET, E.C.,
And at STROUD, GLOUCESTERSHIRE.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY

RAVENSTHORPE, NEAR DEWSBURY.

Telephone: Castleford No. 214. | Postal Address: Castleford.

Telegrams: "Silkstone Castleford."

THE SILKSTONE & HAIGH MOOR COLLIERIES, LTD.

ALLERTON BYWATER, CASTLEFORD.

Steam, Manufacturing, & Gas Coals & Cannel.

Analysis, Contracts, Trial Waggons, and Quotations for Large and Small Orders. Inquiries Solicited.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

INCANDESCENT GAS LIGHTING

Has now gained a complete and final Victory over its last and greatest Enemy

VIBRATION,

BY MEANS OF

CLAY'S PATENT

SHOCK-PROOF

Incandescent Burner Fittings

Of which full Particulars may be had from

CLAY & WALMSLEY,

BOLTON, ENGLAND.

Telegrams: "CLAYS, BOLTON."

See "JOURNAL OF GAS LIGHTING," July 7, 1896, p. 19, and Dec. 21, 1897, p. 1365.

London Representatives: Messrs. Henry Greene & Sons, 153 & 155, Cannon Street, E.C.

ALEXANDER CAMERON,

GAS AND CANNEL COAL MERCHANT,

48, WEST REGENT STREET,

GLASGOW.

GAS PURIFICATION BY

HYDRATED OXIDE.

THIS Material is of full Strength, and Exceptional Activity. It is specially prepared to minimize Back-Pressure; and will be supplied on Hire, or Sold, on the most favourable Terms.

SPENT OXIDES containing Blue, also CRUDE FERRO-CYANIDE PRODUCTS, either PURCHASED or EXCHANGED for FRESH OXIDE.

MANCHESTER OXIDE COMPANY, LTD., CANAL ST., MILES PLATTING, MANCHESTER.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas. Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.

CHESTERFIELD.

HOLMSIDE

GAS COALS.

Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . . 11,205 Cubic Feet.
Illuminating Power $16\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality) $13\frac{3}{4}$ Cwt. per Ton.
Sulphur . . . . . A little over 1 per Cent.
Ash . . . . . Under 1 per Cent.
Tar . . . . . 163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor 103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England, and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR

PELTON GAS COALS.

Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,

HOLMSIDE & SOUTH MOOR OFFICES,

NEWCASTLE-UPON-TYNE.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

97, WELLINGTO STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. EDWARD PRICE, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day. Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

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THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:

80, CANNON STREET, E.C.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL CO., LD.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the

WEARDALE IRON & COAL CO., LD.

QUAYSIDE, NEWCASTLE-ON-TYNE.

REGENERATIVE RETORT-SETTINGS.

J. FIRTH BLAKELEY & CO., GAS ENGINEERS AND CONTRACTORS, RAVENSTHORPE, YORKS,

Have made arrangements with Mr. ALEXANDER YUILL, of Alloa, N.B., for the SOLE RIGHT of BUILDING his REGENERATIVE FURNACES and SETTINGS OF RETORTS.

By Mr. Yuill's Principle, the maximum quantity of Gas per Retort per diem may be obtained with the minimum amount of fuel.

Gas Managers who are desirous of improving their Settings should ask for Particulars and Prices before adopting any other principle. They give the best results, are reliable, and economical in construction.

GAS APPARATUS OF ALL KINDS SUPPLIED.

THE

COWAN PRESSURE SYSTEM

SECURES a constantly responsive adaptation of the Governor pressure to the demands of the district—at all times, and under all circumstances!

FOGS!

DULL WEATHER!

SUDDENLY INCREASED DEMAND!

SUDDENLY REDUCED DEMAND!

Cause no anxiety, to either the Seller or Buyer of Gas, **when the Cowan Pressure System is employed.**

This System maintains any desired pressure in the most remote, or what, **but for it,** would be the worst supplied part of the district, and, by so doing, provides adequately—but never excessively—for the needs of the whole district.

Particulars on application to

W. & B. COWAN, LTD.

— ESTABLISHED 1827 —

SMITH SQUARE WORKS, WESTMINSTER, **LONDON, S.W.** | DALTON STREET WORKS, NEWTOWN, **MANCHESTER.** | BUCCLEUCH STREET WORKS, **EDINBURGH.** | COLONIAL METER WORKS, MACQUARIE PLACE, **SYDNEY, N.S.W.**

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

Shipments Promptly and Carefully Executed.

London Office: R. Cull, 84, Old Broad St., E.C.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to

W. H. PARKINSON,

THE HARTON COAL CO., LTD.,

NEWCASTLE-ON-TYNE.

Telegraphic Address: "PARKINSON NEWCASTLE."

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Telegrams: "EVESON, BIRMINGHAM."

EVESON FOR CANNEL

TUBES AND FITTINGS

ALL KINDS

WRITE FOR PRICES

STAFFORDSHIRE TUBE Co., BIRMINGHAM.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·4 candles.
Coke	68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.,

8 Lombard Street,

NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road,

CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

Note.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

Coal Owners, Newcastle-on-Tyne;

OR

E. FOSTER & CO.,

21, John Street, Adelphi, London, W.C.

MESSRS.

GRAHAM, MORTON, & CO., LTD.

ENGINEERS & CONTRACTORS,

79 & 80, AMBERLEY HOUSE, NORFOLK ST., STRAND, LONDON, W.C.

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OF

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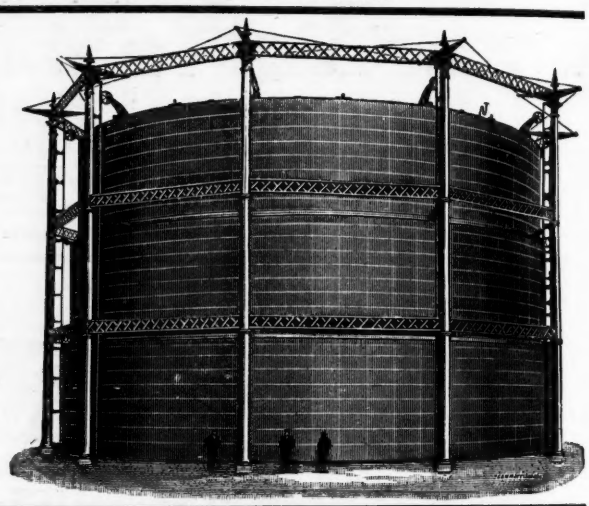

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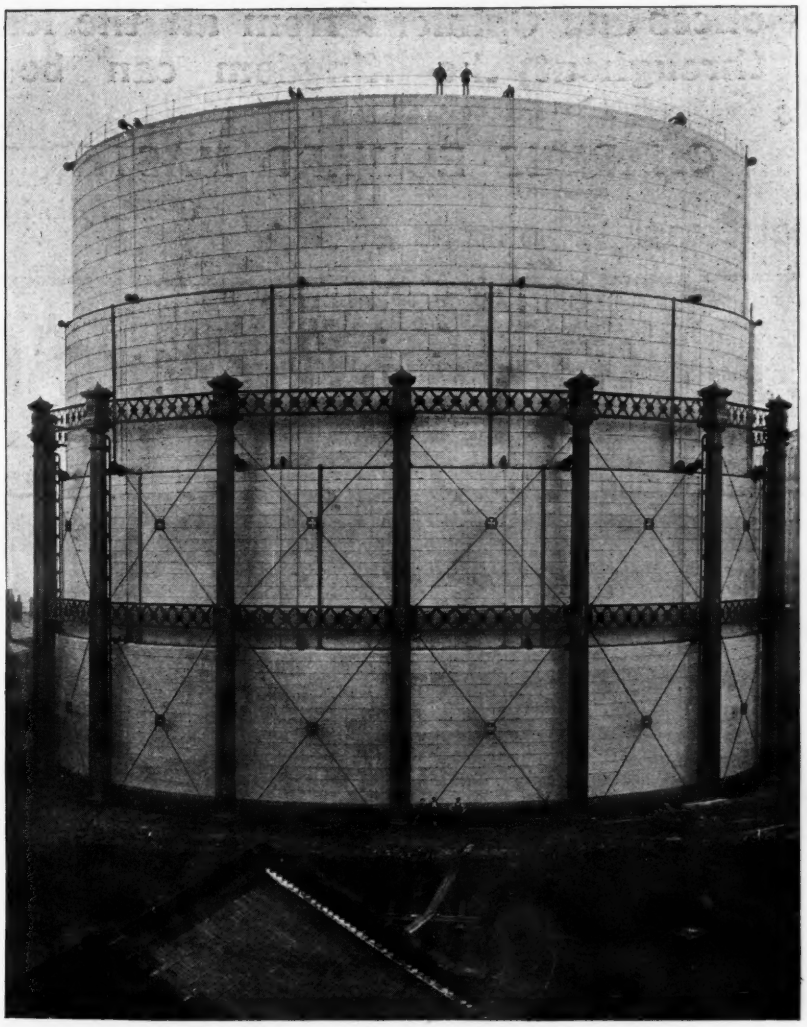

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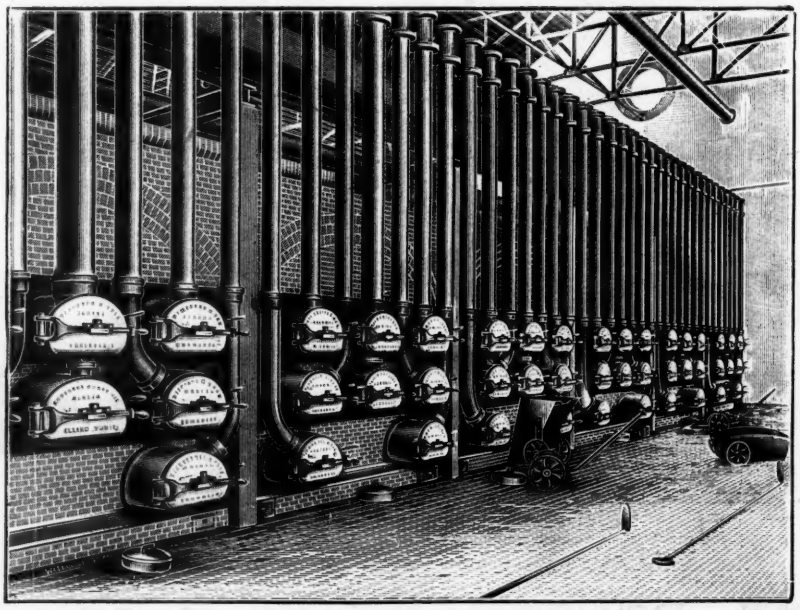

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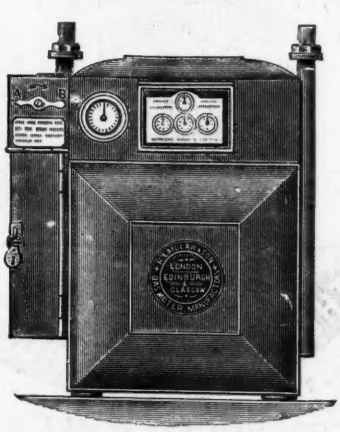

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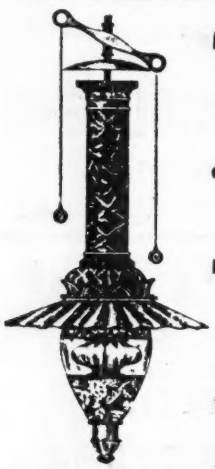

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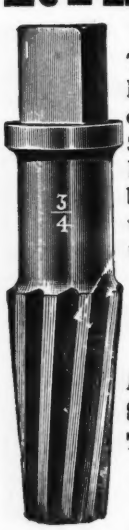

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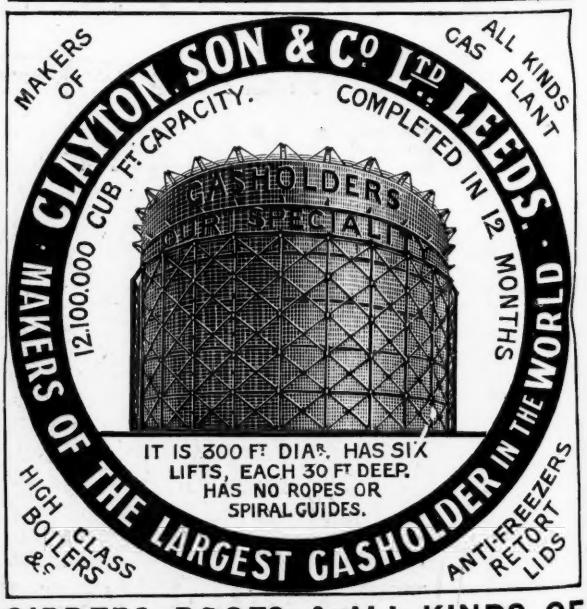
[See Illustrated Advertisement, March 1, p. 449.]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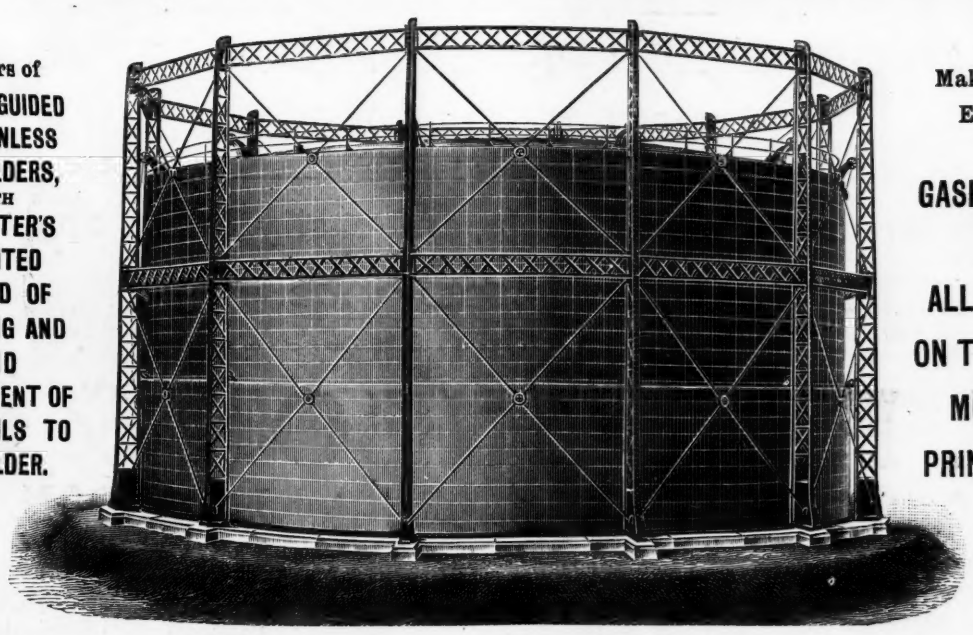

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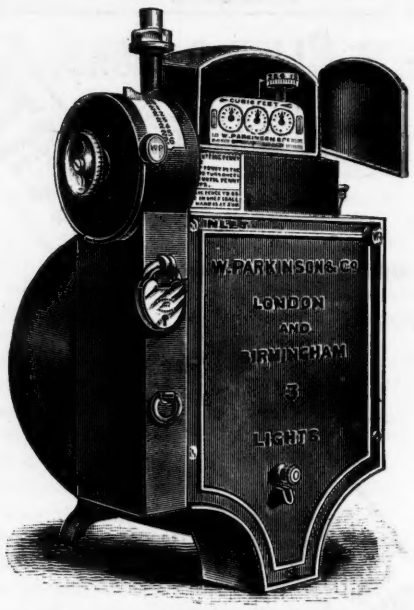

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[See also Advt. p. 636.

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